PUBLIC LIBRARY
CITY OF DETROIT

Standard Size, 9 x 12. Price, Six Cents.

# AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE
AMERICAN MACHINIST PUBLISHING CO.,
256 BROADWAY, NEW YORK.

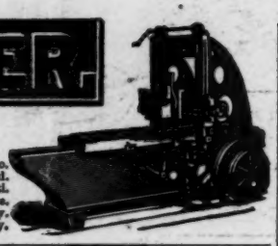
## Some Leading Articles in this Number.

A Manufacturing Machine Shop.
Assembling Cycle Wheels.
Home-Made Lathe Chuck.
A New Steam Calorimeter.
Magnetic Chucks for Holding Work.
Machine Shop Practice in Making Commutators.
A Business Side of Special Fixtures.
Value of Reputation in the Machine Tool Business.
Metrological Standards.

NINETEENTH YEAR.

No. 29.
July 16,
1896.

# THE GRAY PLANER.



MANUFACTURED BY
**THE G. A. GRAY CO.,**
CINCINNATI, OHIO.

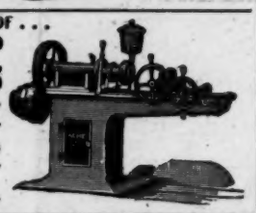
THE FOLLOWING MACHINERY MERCHANTS CARRY SAMPLES.

| | |
|---|---|
| J. A. Fay & Egan Co., | 34 South Canal Street, Chicago. |
| Strong, Carlisle & Turney Co., | 193 Bank Street, Cleveland. |
| E. A. Kinsey & Co., | 221 West 4th Street, Cincinnati. |
| Thos. K. Carey & Bros. Co., | 98 Light Street, Baltimore. |
| J. J. McCabe, | 14 Day Street, New York City. |
| Schuchardt & Schutte, | Berlin, C., Germany. |

## THE ACME Machinery Co.

CLEVELAND, O.

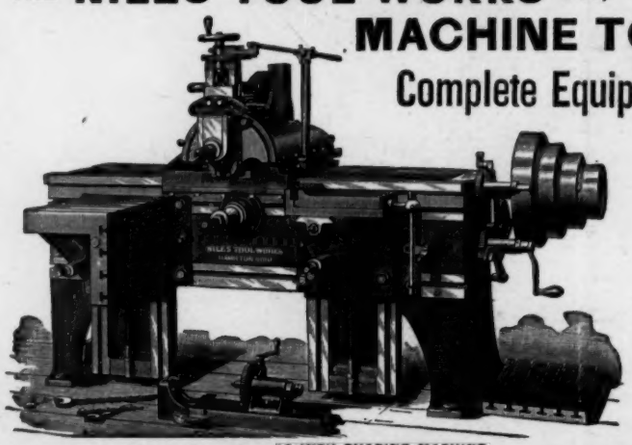
MANUFACTURERS OF . . .
ACME BOLT AND RIVET HEADERS, ACME SINGLE AND DOUBLE AUTOMATIC BOLT CUTTERS, cutting from 1-8 in. to 6 in. diam.
ALSO SEPARATE HEADS AND DIES.



## THE NILES TOOL WORKS CO., HAMILTON, OHIO.

## MACHINE TOOLS.

Complete Equipments.



NEW YORK,
CHICAGO,
BOSTON,
PHILADELPHIA,
PITTSBURGH.

18-INCH SHAPING MACHINE.

## William Sellers & Co. Incorp. PHILADELPHIA.

**HAVE YOU EXAMINED ?**

**THE NEW TOOL GRINDER No. 2 ?**
**THE CENTRIFUGAL SAND MIXER ?**
**THE VICARS' MECHANICAL STOKER ?**
**THE NEW RESTARTING INJECTOR ?**

These may be seen in operation at our establishment.
Descriptive Circulars Mailed on Application.

No. 15 Plain Power Milling Machine.

## THE GARVIN MACHINE CO.

MAKERS OF AND DEALERS IN

## Metal-Working Machinery

OF EVERY KIND.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Turret Lathes, Shapers, Gear Cutters, Die and Cutter Grinders, Tapping Machines, etc., etc.

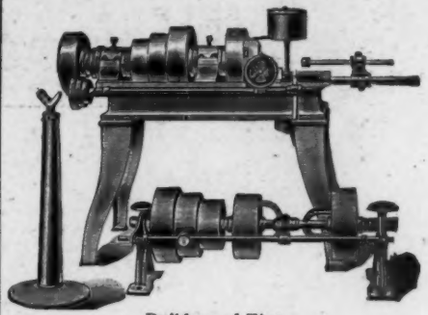
A COMPLETE LINE OF

## Special Bicycle Machinery

WRITE FOR CATALOGUES AND LIST OF NEW AND SECOND-HAND MACHINERY FOR IMMEDIATE DELIVERY.

Spring and Varick Sts., NEW YORK.
51 North 7th St., PHILADELPHIA, PA.

## THE W. P. DAVIS MACHINE CO.



Builders of Fine

ENGINE LATHES,
From 12 to 30 inch swing.

UPRIGHT DRILLS,
From 10 inch Sensitive to 36 in., with B. G. and P. F.

ALSO

KEYSEATING and CUTTING-OFF MACHINES.

ROCHESTER, N. Y., U. S. A.

Send for Circulars and Photographs.

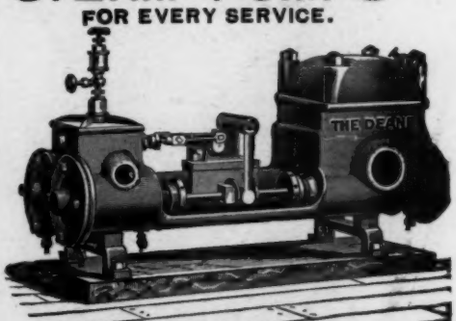
"Every machine running in your works is a monument to your intelligence or ignorance—a money maker or a money eater.

The Flat Turret Lathe will do nearly all of your lathe work under 2 inches in diameter and less than 24 inches long. It will save $1,000 to $1,500 over lathe work, and $400 to $600 over any other turret machine. Sold on guarantees. Our own representatives will call on request. "Rapid Lathe Work" sent free.

▲ ▲ ▲

JONES & LAMSON MACHINE CO.
Springfield, Vt.

## THE DEANE
OF HOLYOKE
## STEAM PUMPS
FOR EVERY SERVICE.



BOILER FEED PUMP.

## DEANE STEAM PUMP CO.,
HOLYOKE, MASS.
NEW YORK. BOSTON. CHICAGO.

# AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

▲ ▲ ▲

NEW YORK, THURSDAY, JULY 16, 1896.

VOLUME 19. ▲ ▲ ▲ NUMBER 29.


## A Manufacturing Machine Shop—I.

The shop which is to be described was built at a very small cost for its floor surface, is excellently lighted, has good ventilation, is insured at very low rates, and calls for the minimum of unremunerative labor on the part of superintendent, foremen, workmen and clerks. Believing this shop to be among the very best in the world, nothing has been spared in the way of text or illustrations necessary to give a complete description of its buildings, tools and general methods of shop procedure, as it is a shop to which the public has not hitherto been admitted.

Assuming the square foot of floor area as the comparative unit for shop values, it is evident that this unit can be a correct measure of effective shop capacities only when each and every square foot of floor surface is equally available for productive use. Each square foot of floor surface must be so lighted, so heated, so accessible, so able to sustain loads and so

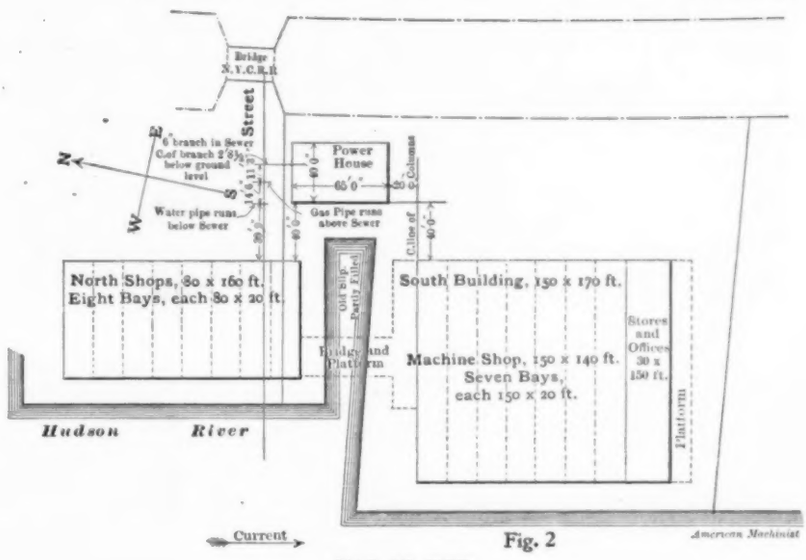



Fig. 2

MAP OF SITE.

EXTERIOR VIEW OF SHOP.

ventilated as to be of value as a productive factor in the output of the entire concern. Not only this, but it must also be open to observation, repairs, and extension at the smallest cost of labor to both workmen and superintendent; it must be easily reached by the motive power needed to drive the various machines which stand upon it, and the first cost of each foot of floor surface should be the same, and that cost must be as small as possible. The risk of destruction by fire must also be small, to reduce the fixed charges of insurance and interest to the lowest attainable point.

Fig. 3. SUPERINTENDENT'S OFFICE.

Fig. 4. VIEW OF STORE ROOM.

Very few shops have every square foot of floor surface so accessible, so warmed and so lighted as to be equally available productive factors of the output. In many shops which would be pronounced good, or even very good, on casual inspection, large floor areas exist which, by nearness to frequently opened doors, or want of light, or needless lines of shop travel, including avoidable stairways, elevators and the like, are practically transformed into waste places—mere vacancies, which have to be warmed and cared for, and walked around and through, without in any way adding to the productive powers of the shop; but, instead, actually decreasing the output by the increased transportation always consequent upon unproductive territory.

The cost of a square foot of perfectly lighted, heated and powered machine shop floor may be, and is in one of the very latest examples of first-class shop construction, as much as $3.75 per square foot for the gross floor area, deducting nothing for stairways and areas otherwise made unavailable for manufacturing operations, and it can, as in the noteworthy example about to be detailed here, fall as low as 75 cents per square foot, and yet have every foot of floor in the building equally and perfectly available for productive use. Joined with this cheap floor space, there may be such well-considered cost-keeping, stock-handling methods and process steps of manufacture, and such facilities for superintending observation, as to reduce the fixed shop

charges to a very small percentage of those sustained under what are commonly regarded as fairly good methods of procedure.

The De Laval separator is a machine for separating cream from milk, the effective action of the separator being based upon the differing specific gravities of the various ingredients which go to make up that complex fluid; the method being to submit thin inclined annular rings of milk to high rotative velocities, during which the lighter cream disposes itself nearer the center of revolution than the heavier watery fluids which constitute the larger portion of the milk. Advantage is taken of these centrifugally-affected differing locations of the cream and milk to lead the separated fluids into different ducts, and finally deliver $\frac{999}{1000}$ of the total cream originally contained in the milk in a steady stream into one receptacle; while the skimmed milk, so almost absolutely deprived of its fatty parts, flows into another. Broadly, the process is old; but such an application of it as makes its action continuous is modern, and of great commercial value under the present established creamery methods, by which the product of many dairy farms is taken to one central establishment, where sufficiently large quantities of milk are handled daily to make the employment of highly-developed labor and time-saving machinery profitable; and the De Laval continuous separator has brought its illustrious Swedish inventor a large fortune. In the United States, the De Laval Company had, in 1891, two small shops for building De Laval machines, one in Brooklyn and one in New Jersey, neither of which was arranged and equipped in the best manner. Under these circumstances it was decided to make a determined effort to reduce the cost, and at the same time improve the mechanical finish of the machines to such a point as to enable the company to hold the trade by virtue of superior machine shop plant and manufacturing methods; and it was under these circumstances that the De Laval Company began, late in 1891, the reorganization and improvement of the constructive means and methods for the production of the De Laval separator.

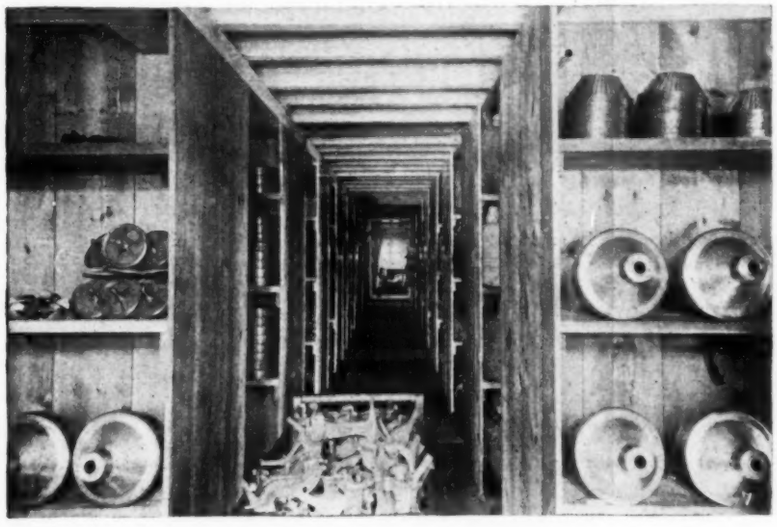
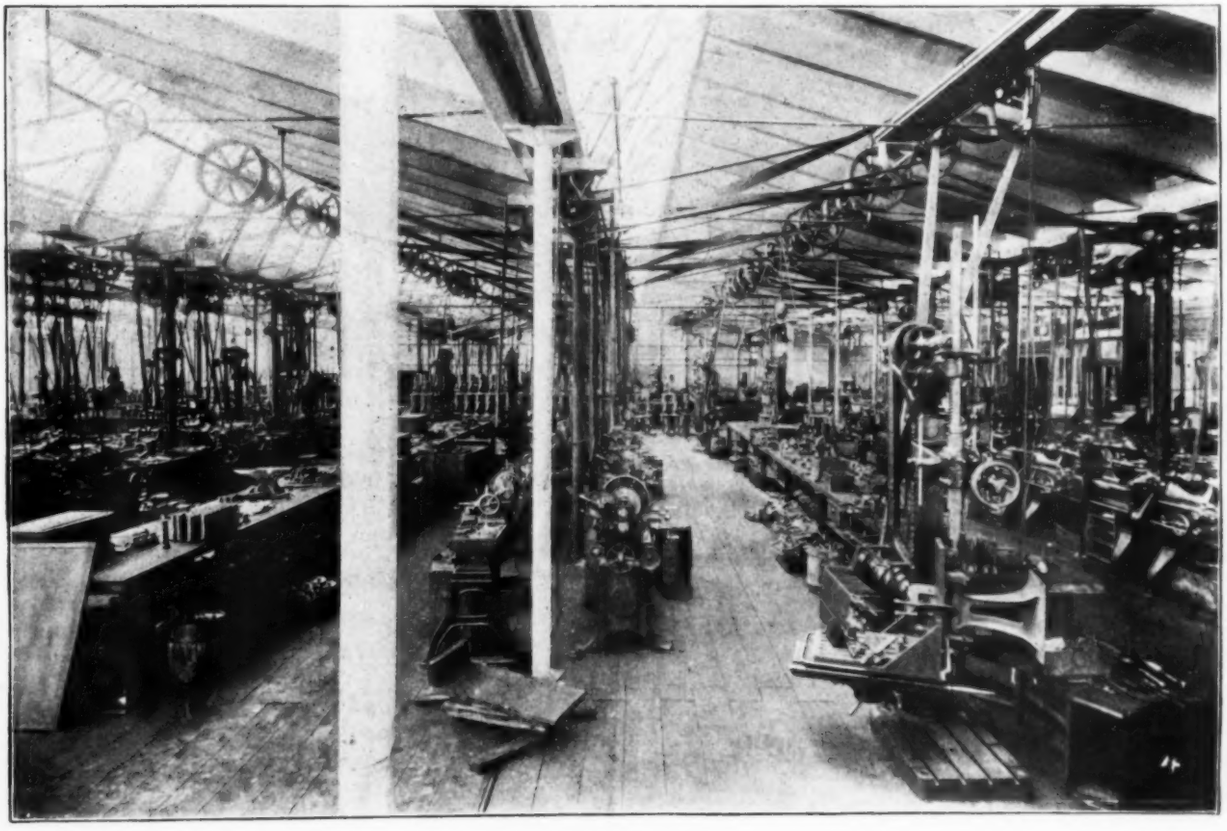


Fig. 5. VIEW OF STORE ROOM.



AN INTERIOR VIEW.

The machine itself, in general form, consists of a wrought-steel perfectly balanced bowl—into which the milk is gradually delivered, and which is rotated at from 5,600 to 7,200 turns per minute—a

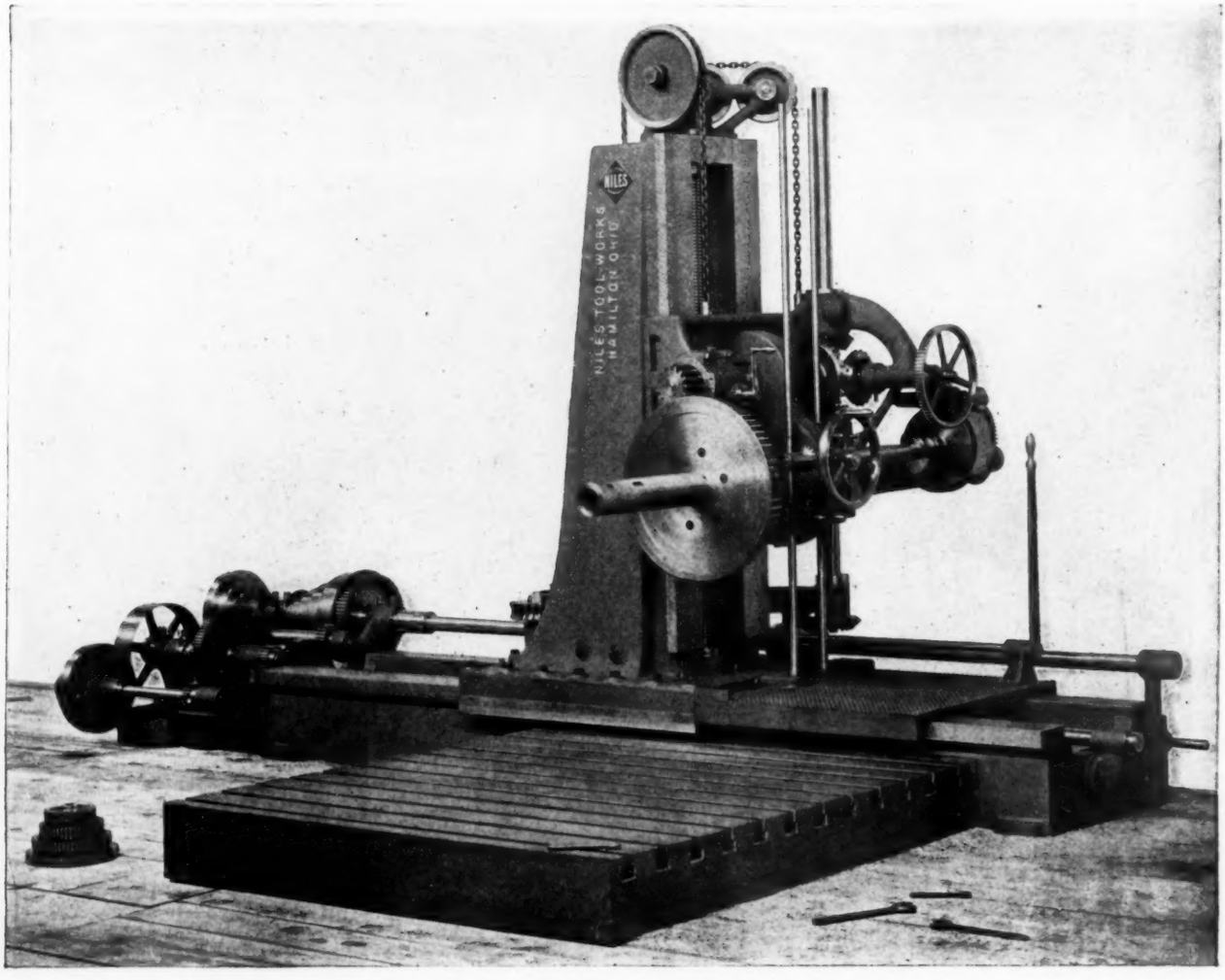
frame for supporting this bowl, and means for giving the bowl its very rapid rotary motion, which is obtained in some cases by belting and in other cases by spur and spiral gearing. These machines vary considerably in size and price, the larger power-driven machines being sold at $750 and the smallest hand-driven machines at $100 each, and the weight of the largest is about 750 pounds, the smallest about 130 pounds. There are ten sizes of separators in all built in the shop to be described, which does no other work whatever, and is shown as it now stands in Fig. 1. Fig. 2 is a map of the site; Fig. 3 is a view of the superintendent's room, looking into the machine shop; and Figs. 4 and 5 are two storeroom views, giving a better idea than could be conveyed by words of the order and system which there prevail.

## Twist Drills with Tubes for Lubricant.

In the present practice of pushing drilling operations to the utmost limit where the drilling is part of a manufacturing system, it is found to be very important that the lubricant shall be at all times just where the cutting is being done, and especially in the case of deep holes it will not do to depend upon gravity for this, but the oil or other lubricant must be forced to the cutting lips.

TWIST DRILL WITH TUBES.

We illustrate herewith a drill now being regularly made for the purpose by the Cleveland Twist Drill Co., of Cleveland, O. Midway in the "land" on each side a groove is milled, into which a small brass tube is laid and soldered. These




BORING, DRILLING AND MILLING MACHINE.

## Boring, Drilling and Milling Machine.

In its general features the machine shown herewith is familiar to those who have to do with modern machine-shop work of medium or heavy proportions, and we illustrate it because it represents recent practice.

The machine was designed especially for boring and facing work of large diameter, and on this account is fitted with a face plate and an extra pair of driving gears, which, besides being of relatively large diameter, are as close to the work as they can be placed. The machine has sufficient power and stiffness to efficiently bore up to 40 inches diameter, and it can face generator rings and other work of that character.

As a face-milling machine this tool is, of course, quite effective. Its vertical traverse is 3 feet; horizontal traverse, 8 feet; size of table, 6 feet square; diameter of spindle, 4½ inches. It is built by the Niles Tool Works, Hamilton, O.

tubes project at the upper end of the drill, as shown, and the lubricant, forced into them, goes to the cutting lips, not only keeping things cool, but also greatly assisting, by its rapid flow outwards, the removal of chips. They are made in sizes ranging from ¾ inch to 1 5-16 inches diameter, and with straight or taper shanks.

▲ ▲ ▲

## German Shipbuilding.

A new steamer is now building at Stettin for the North German Lloyd line, to compete with the flyers of the Cunard and the American lines. She is to be 625 feet long between perpendiculars, or more than 650 feet over all, 66 feet wide and 43 feet deep inside, with engines close to 30,000 horse-power. Another ship of the same dimensions is being built at the Schichau yard at Dantzic. The Hamburg-American line will soon have the largest freight steamer in the world; this, however, is being built at Belfast. It is a twin screw ship 560 feet long, 62 feet wide and 41 feet deep, with a cargo capacity of 12,000 tons, or, say, that of 400 freight cars.

Although Germany's fleet of merchant sailing ships is smaller than that of Great Britain, she has the largest ship of the kind afloat and several of the swiftest. The "Potosi" is a five-masted ship 360 feet long inside, 50 feet wide and 31 feet deep, with a cargo capacity of 6,200 tons. She spreads 50,020 square feet of canvas. One German ship made a voyage of 13,485 nautical miles at an average speed of 8.14 knots per hour. Another ship made 6,425 miles at 9.25 knots.

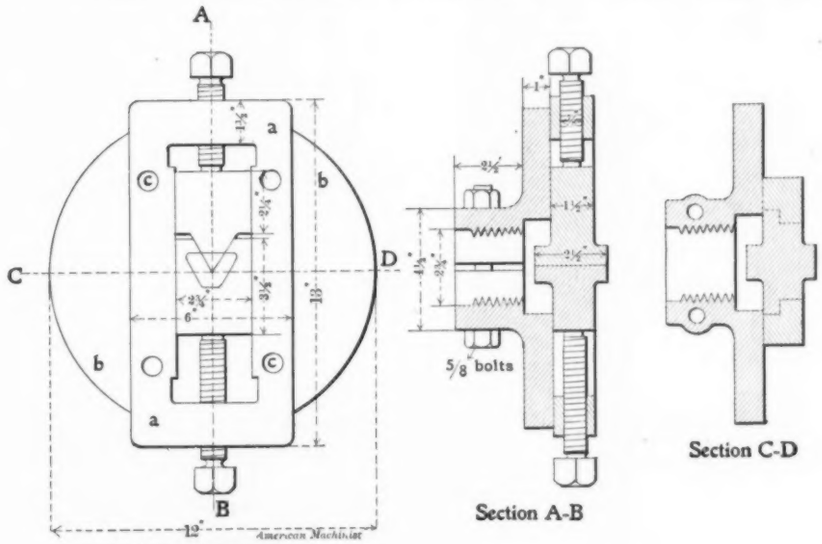
In shipbuilding, the Germans have some disadvantages. Nearly all kinds of materials are higher at her shipyards than at the British yards. Labor is somewhat lower; but the distance of the mines, especially of coal mines, more than makes up the difference. The builders are also burdened by laws compelling contributions to old age pension funds and accident insurance associations.

▲ ▲ ▲

## A Home-Made Lathe Chuck for Bar Iron.

BY C. O. GRIFFIN.

The unsatisfactory nature of the universal chuck for manufacturing operations on bar stock led me to devise the chuck shown herewith. During its lifetime of five years, it has never been in the hospital and has given thorough satisfaction. It is so simple as scarcely to need a description. The forged yoke *a a* is bolted to the face plate *b b* by tap bolts *c c*, put in from behind. The yoke is undercut, as shown, to keep the V-jaws in place. One jaw is male and the other female. They are flush with the surface of the yoke except for the lips at the gripping ends, which increase the length of the hold on the stock. The jaws are operated by good honest steel set screws, and will hold till kingdom come. The hub for the lathe spindle nose is split, and gripped to the nose by bolts to prevent unscrewing when backing out taps and dies. This feature overcomes a common nuisance, and is applicable to other patterns of chuck.




HOME-MADE CHUCK.

When used for turret lathe work (for which it was, in fact, first made) the same jaw is always left undisturbed in shifting the stock for a new piece, thereby making the chuck self-centering for all pieces except the first.

One of the things which we do not half appreciate in this country is the Englishman's bell chuck, which is simply a bell-shaped casting screwed on the lathe spindle, and fitted with set screws around the edge for holding the work. This chuck is simple and cheap, and for special work cannot be equaled. However, I may have more to say and to show about this construction at another time.

## Bicycle Tools—XXVIII.

Wheel-truing stands, in which wheels are placed and spun around by hand while being trued, vary greatly in appearance, but come to about one thing when essentials are considered. In all cases the wheel is mounted on ball centers, so that it runs on balls filling its own ball cups, same as it is to run in the finished machine. In some cases these truing frames are mounted on the ordinary work benches, in some cases on special benches, and in some cases the truing frames are made full length and stand on the floor. Generally the workman stands up while truing wheels, but in some shops he sits.

When assembled wheels are brought to the truing bench, the first thing is to put about an equal tension on each spoke, regardless of the truth of the rim. In the Lozier shops (see Fig. 176, "Cycle Tools—XXVII," second operation) this equalizing spoke tension operation is done on a rough-truing table, and not only equalizes the spoke tension, but brings the rim pretty nearly true. In the Gormully & Jeffery shops, Fig. 180, equalizing spoke tension is made a special operation, the wheel being held by one hand and knee of the workman, while with the other hand he turns the crank of a little gooseneck framed machine which has an open-gear-driven, revolving, nipple-turning spindle; the spoke is slipped into an axial position through a slot in the revolving nipple wrench spindle, and the crank is turned until the nipple is up tight in place, as shown in the foreground of Fig. 180. Then the wheels are put into the truing stands, and the rims are brought perfectly true by changing the spoke tension, relaxing and increasing it by turning the nipples. Sometimes the truing gage is at the bottom of the truing stand, as in Fig. 180; sometimes it is at the rear, as in Fig. 181, showing the "Columbia" wheel-truing stand, which is a very neat, independent structure, reaching to the floor, and having a little independent tool bench and hand rest of its own, both the fork and the bench being independently adjustable for height. The workman stands in front of the machine, as shown in Fig. 181, thus bringing the tool bench under his right hand. The front center is made to slide, and is fixed in the desired location, where the wheel will just run free without shake, by the usual tail-stock binder and hand-screw. This is a thoroughly Yankee machine, adjustable all over, and having every essential for the avoidance of needless labor. The Gormully & Jeffery wheel stand is substantially the same thing, but has the truing gage at the bottom instead of at the side, because the Gormully & Jeffery truing stands sit on the ordinary work bench, and so are brought very high, the wheel centers being about eye-high as the wheel truer sits at his work, as is the case of the second workman from the front in Fig.

180. The third workman is seen standing up, bringing the top of the wheel a little above his eyes. In Fig. 180 the second workman grasps two spokes and forces them toward each other, to slightly vary the position of an untrue spot in the rim without turning the nipples. But in most cases the nipples have to be turned, and an increase of tension on any spoke is liable to affect remote portions of the rim; hence, great skill and experience are required in the art. A novice finds that in correcting one error he has created another, which is a not unusual experience in matters having nothing to do with bicycle wheels, and is always quite discouraging. Practice soon teaches the workman what spoke must be changed to remove an error in a certain spot on the wheel rim, and expert wheel-truers go at the right one every time.

At the Lozier shops the wheel-truers sit at their work, as shown in Fig. 182, and the truing gage is in U-form, secured to the fork uprights and brought out in front, directly under the eye of the workman. The side of the gage is pierced with holes in which a truing pin is slipped to test the truth of the wheel rim, either inside or at the edge as it spins on its axis. Where the workman uses his thumb-nail as a gage he is liable to move it when he does not intend to do so, and the gage pin held as it is shown in Fig. 182, in its seat, is more reliable.

The Lozier wheels are trued with great care, and do not leave the stands until they run right both on the inside, side and outside edges, which is much more than can be said of the work in some shops, and more than can be said of wood-rim wheels in any cycle which is in use on the road. In the repair shops the wheels are always "spun" and examined for truth before the machine is delivered, no matter

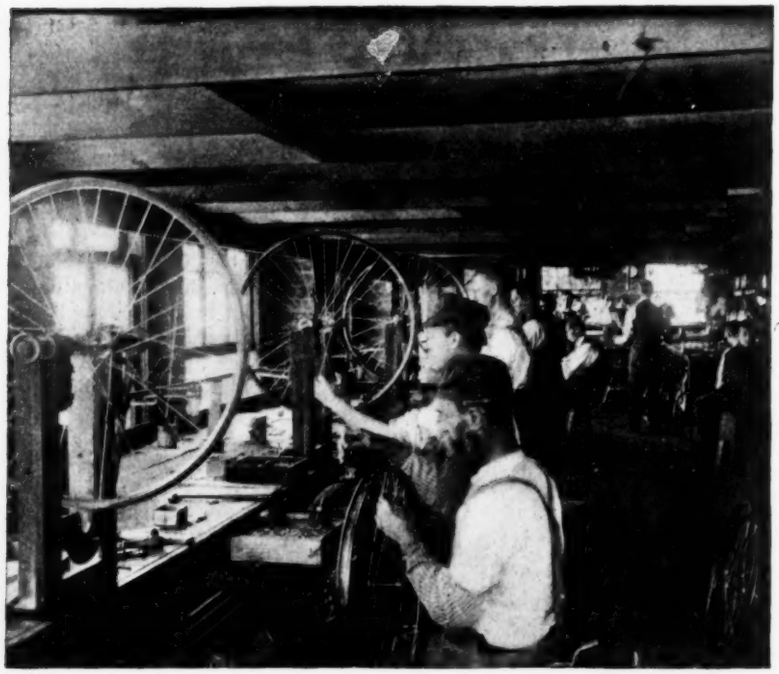


Fig. 180. ADJUSTING SPOKE TENSION—GORMULLY & JEFFERY SHOPS.

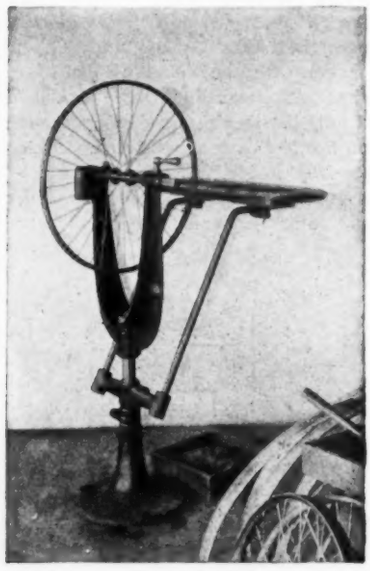


Fig. 181. COLUMBIA WHEEL-TRUING STAND.

Fig. 182. WHEEL-TRUING—LOZIER SHOPS.

Fig. 183. SOLDERING SPOKE CROSSINGS WITH SOLDERING IRON.

what the repairs have been, and no wood-rim stays as true as it is when it leaves the truer's hands for any very long time. This is not to be understood as any argument against the wood rim, or against the use of wood in any part of bicycle construction. The York Mfg. Co. have put out a thousand of their wood-frame cycles, in which the "diamond" is a single "laminated" structure of hickory strips ⅛ inch thick, laid up in waterproof cement, and

Fig. 184. GRINDING OFF SPOKE ENDS—GORMULLY & JEFFERY SHOPS.

is both lighter and stronger than a steel diamond. Wood-frame cycles are also made by the Husby Cycle Co., Milwaukee, Wis.; the Anderson Harris Carriage Co., Elmwood place, O. (a Cincinnati suburb); the Beebe Mfg. Co., carriages, Racine, Wis., and perhaps others, and there is a rattan-frame machine made at Trenton, N. J. From all that is now known in regard to the use of wood in cycle construction, I am led to believe that the wood wheel rim is much less likely to go out than the wood diamond is to come in; and no matter whether the wood rim stays true after it is once made true or not, its real rival must be looked for in some other fibrous material—perhaps in manilla paper, rather than in the steel rim which it so surprisingly displaced.

Fig. 183, from the Gormully & Jeffery shops, shows soldering the spoke crossings with a hot copper and strip of solder. Some shops use a small gas flame, and some shops use a stamped sheet-metal clip, without solder. In Fig. 183 a large heavy copper is used, which is heated in the lead pot seen at the right of the workman, this lead pot being heated by a gas fire. Soldering coppers are often heated by an internal gas fire, the air and gas being led into the body of the copper through flexible hose connected to the end of the handle, and are also often heated in gas muffles. Neither of these methods keeps the tinned part of the copper so free from oxidization as the lead bath. In case of the cycle spoke crossing, each intersection must have two or three turns of fine wire before soldering; hence, if the solderer winds the spoke crossings the copper has abundant time to heat. Even if he does not wind the crossings, the lead bath heats the copper so rapidly as to cause no delay, as there is time enough while the solderer lays a finished wheel down, and picks up another and goes over the joints with the acid brush, to heat the copper, which is always perfectly clean and large enough to keep its heat while soldering all the crossings in a wheel. Soldering with a flame is a quick, clean operation, but not as rapid as with the copper, nor is the joint likely to be so cleanly soldered with the flame. The copper is perfectly clean and "takes" instantly; the workman touches the crossing with the nose of the copper, and then touches the solder strip to the side of the copper, and just enough solder to bind the joint instantly flows into place. So little surplus solder is used that it is often hard to see that the winding is soldered at all, although it is really perfectly secured.

The spoke is always made plenty long enough, and in many cases the end sticks out through the nipple a little way when the wheel is done. This projection is removed by grinding, as it cannot be allowed to remain where it would hurt the inflated tire. In all shops except the Gormully & Jeffery, so far as observed, the spokes are ground down even with the nipple-end on a small emery wheel, the cycle wheel being brought up by hand only. In the Gormully & Jeffery shops a fixture is used consisting of an axle in the form of a stud in the side of a pivoted, wooden, knee-actuated lever, hung at the right-hand end in Fig. 184, and resting on the workman's knee at the left end. The bottom of the wheel runs away from the workman, and is about eye-high as he sits with both hands free to handle the wheel, where he can see with perfect ease when the spoke-end is cut down to the nipple level. At the Gormully & Jeffery shops this method is thought far better than grinding with the wheel held simply in the hands of the workman, as the liability to touch the wood rim to the emery wheel is greatly lessened by the use of the rig shown. The workman also grinds more wheels with the fixture, and the emery-wheel cut is always made exactly square across the axis of the spoke, which is very desirable, as, if made oblique, the sharp lip of the spoke-end might sometime project far enough to cut the rubber.

HUGH DOLNAR.

▲ ▲ ▲

## A New Form of Steam Calorimeter.*

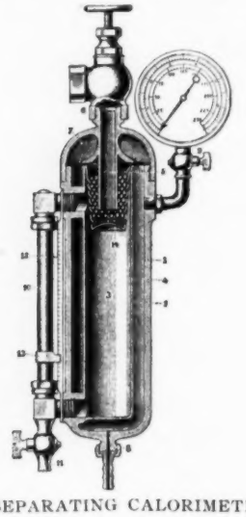
BY R. C. CARPENTER, ITHACA, N. Y.

This calorimeter has been in use at Sibley College about a year. The apparatus consists of two vessels, one within the other, the space between them answering for a steam jacket. A water gage glass 10 connects with the interior vessel. Steam to be tried enters through pipe 6 into the upper part of the interior vessel. The water in the steam is thrown downward into the cup 14 with more or less steam; the steam and water then turn upward, and most of the water is thrown outward through the meshes of the cup and down into the space 3 below. The cup prevents the steam from taking up any moisture which has already been thrown out by the force of inertia. The steam then enters the top of the outside chamber, and is discharged through an orifice 8 of known area, which is much smaller than any section of the passages,

* Abstract of a paper presented at the St. Louis meeting of the American Society of Mechanical Engineers, May, 1896.

so that the steam in the outer chamber suffers no sensible reduction in pressure. The pressure in the outer chamber being the same as in the interior, they have the same temperature, and no loss by radiation can take place from the interior chamber except from the exposed surface of the gage glass. The pressure in the outer chamber, and also the flow of steam, is shown by the gage. The scale for the flow of steam is the outer one; it is graduated by trial and gives the weight discharged in ten minutes.

By Napier's law, the flow of steam through an orifice from a higher to a



A SEPARATING CALORIMETER.

lower pressure is proportional to the absolute steam pressure, until the pressure against which the flow takes place equals or exceeds .6 of that in the vessel under pressure. The reading of the pressure gage is proportional to pressures above the atmosphere, and hence the calibration curve will not give results proportional to gage readings. The values of the calibrations on the gage can readily be verified by condensing the discharge steam for a given period of time.

The graduations of the scale 12 attached to the inner vessel show the weight of water which has been separated from the steam. The percentage of moisture in the steam is found by dividing the weight of water, as shown on the inner reading of the gage, by the sum of this quantity and that shown on the attached gage; the quality or percentage of dry steam by dividing the difference of the readings by the sum.

In the use of the instrument, the outer vessel and connected pipe through which the sample is obtained should be carefully clothed to prevent unnecessary loss of heat by radiation.

The total size of the instrument is about 10 x 2½ inches, and its weight about 6 pounds, so that it is in portable and convenient form.

The accuracy of the instrument depends first on the accuracy of the scales; second upon the complete separation of the water from the steam by the separator. This was tested by discharging the steam from the outer vessel through a throttling calorimeter. Nearly one hundred observations were made, the average results of which, as given in the following table, show the exhaust steam in the conditions tested to have a quality of 99.998 per cent. As it is certain that some loss of heat occurred between the two instruments, we can consider with confidence the steam as passing from the inner into the outer vessel perfectly dry and saturated.

A considerable error in the weight of steam discharged will affect the results but very little, since in every practical case the moisture is a small percentage of the total. Thus, supposing that the results show five per cent. moisture, but that an error in the weight of the steam discharge of five per cent. has been made: In that case the correction to our result should be but .05, or one-twentieth of the results obtained, in this case amounting to one-fourth of one per cent. The above is an extreme case and is several times greater than any that is likely to occur.

The exposed surface of the water glass is a very small portion of the whole surface, and the loss by radiation is an exceedingly small amount; it affects the results less than errors of observation. Professor W. C. Unwin, in a paper read before the Institution of Civil Engineers, on the Determination of the Dryness of Steam, gives tests of this instrument as compared with a throttling instrument, and considers that the results in every case practically confirm each other.

The question has recently been raised regarding the value of calorimetric determinations, from the fact that great difficulty is experienced in obtaining a sample of steam which fairly represents the average in the steam pipe. The following conclusions may in a certain measure serve to guide calorimetry practice:

First—The steam ordinarily discharged from a boiler of proper proportion and in good working condition carries an exceedingly small percentage of water.

Second—A certain amount of water will be carried along by the steam in the form of vapor or small drops; that this amount varies somewhat with the velocity, but probably does not exceed two or three per cent. by weight, and furthermore, a fair sample of such steam is usually obtained by any of the ordinary methods in use.

Third—Water is sometimes thrown from the boiler in large amounts, and in such a case it will usually remain distinct from the steam and will pass along the bottom of horizontal pipes in a stream of greater or less depth, and will flow if moving downward in a vertical pipe in irregular positions, depending upon its velocity and various other considerations. Steam carrying water in this way when ascending in a vertical pipe will probably be irregularly charged, and samples drawn from time to time are likely to vary greatly. This condition can usually be considered an abnormal one and probably cannot be fairly sampled by any method. In case large amounts of water are thrown over, the quality of the steam cannot be even approximately obtained without the use of a steam separator for removing the excess of water.

Fourth—Steam, even in a very dry condition, is likely to deposit a film of water on the inside of the pipe by condensation. This amount is rarely of sufficient importance to greatly affect the results; but if the calorimeter is so located as to draw

SEPARATING CALORIMETER.

| DETERMINATION OF QUALITY WITH SEPARATING CALORIMETER. | | | | | DETERMINATION OF QUALITY OF STEAM DISCHARGED BY SEPARATING CALORIMETER WITH THROTTLING CALORIMETER. | | |
|---|---|---|---|---|---|---|---|
| Duration run, Minutes. | Gage Pressure, Pounds. | Pounds Separated Water in run. | Pounds Condensed Steam in run | Quality Steam, per cent. | Temperature in Calorimeter. | Quality Steam in Exhaust from Separating Calorimeter. | No. of Observations. |
| 25 | 81.5 | 1.15 | 4.45 | 79.46 | 281 | 99.95 | 6 |
| 25 | 78.2 | 0.15 | 5.20 | 97.2 | 281.3 | 100.00 | 6 |
| 25 | 80.8 | 0.525 | 4.25 | 89.005 | 286.5 | 100.00 | 6 |
| 25 | 79.5 | 0.150 | 4.75 | 96.94 | 281.8 | 99.95 | 6 |
| 25 | 78.5 | 0.300 | 5.000 | 94.34 | 282.8 | 100.00 | 6 |
| 25 | 77.6 | .150 | 5.45 | 97.32 | 282.3 | 100.00 | 6 |
| 24 | 79.5 | 1.8 | 4.55 | 71.65 | 280.1 | 99.94 | 6 |
| 24 | 78.5 | 1.4 | 4.90 | 77.77 | 279 5 | 99.9 | 6 |
| 20 | 83.6 | 1.15 | 4.1 | 77.67 | 286.5 | 100.5 | 5 |
| 20 | 81.6 | 1.70 | 4.75 | 73.64 | 282.7 | 99.98 | 5 |
| 20 | 74.8 | 0.65 | 3.95 | 85.87 | 283.7 | 100.05 | 5 |
| 20 | 82.0 | 0.85 | 3.95 | 82.29 | 286.8 | 100.05 | 5 |
| 20 | 82.6 | 0.35 | 4.15 | 92.22 | 285.6 | 100.0 | 5 |
| 20 | 81.5 | 0.20 | 3.95 | 95.15 | 285.2 | 100.05 | 5 |
| 20 | 81.4 | 2.20 | 4.325 | 66.28 | 283.1 | 100.0 | 5 |
| 20 | 80.3 | 0.30 | 4.55 | 93.81 | 282.8 | 100.0 | 5 |
| 20 | 82.0 | 0.20 | 4.65 | 95.8 | 282.8 | 99.98 | 5 |
| 20 | 81.1 | 0.20 | 4.40 | 95.7 | 284.0 | 100.0 | 5 |

Average of 18 trials, involving 98 observations, 99.998

this directly into the pipe, it may show very wet steam when the contrary condition actually exists.

The writer believes that samples for calorimetric determination should be drawn from a vertical pipe in which there is an ascending current of steam, and that the sample should be taken as uniformly as possible from all sections of the pipe, except that no steam should be drawn immediately adjacent to the exterior portion of the pipe; and in such a case the results will indicate, if substantially uniform, in all cases not showing an excessive amount of moisture, *the average quality of the steam within reasonable limits of errors of observation.*

Further, if the determinations obtained by the calorimeter in this position are irregular, or show large percentages of error, it may be reasonably doubted that the sample of steam obtained is accurate.

Fifth—A steam separator is always desirable to remove excess of water from the main steam pipe, in which case determinations should be taken after the steam has passed the separator. The writer, however, believes from his own experience that the use of the separator will not be found essential in one case out of twenty, for the reason that water is very rarely thrown into the steam in larger quantities than the steam itself will take up and retain in a uniformly distributed condition.

[We understand that the above described calorimeter is being manufactured and placed on the market by Schaefer & Budenberg, New York.—Ed.]

▲ ▲ ▲

## Ball Bearings.

The increasing use of ball bearings in machinery is introducing a new set of problems for the designer and machinist, and we have many inquiries for information regarding co-efficients of friction, number and size of balls to use, etc.

We have to confess that we have so far been unable to secure much definite information on these points, but some experiments made by the late Geo. F. Simonds, of Fitchburg, Mass., the data of which are given by the Ball Bearing Co., of Boston, seem to point to the conclusions:

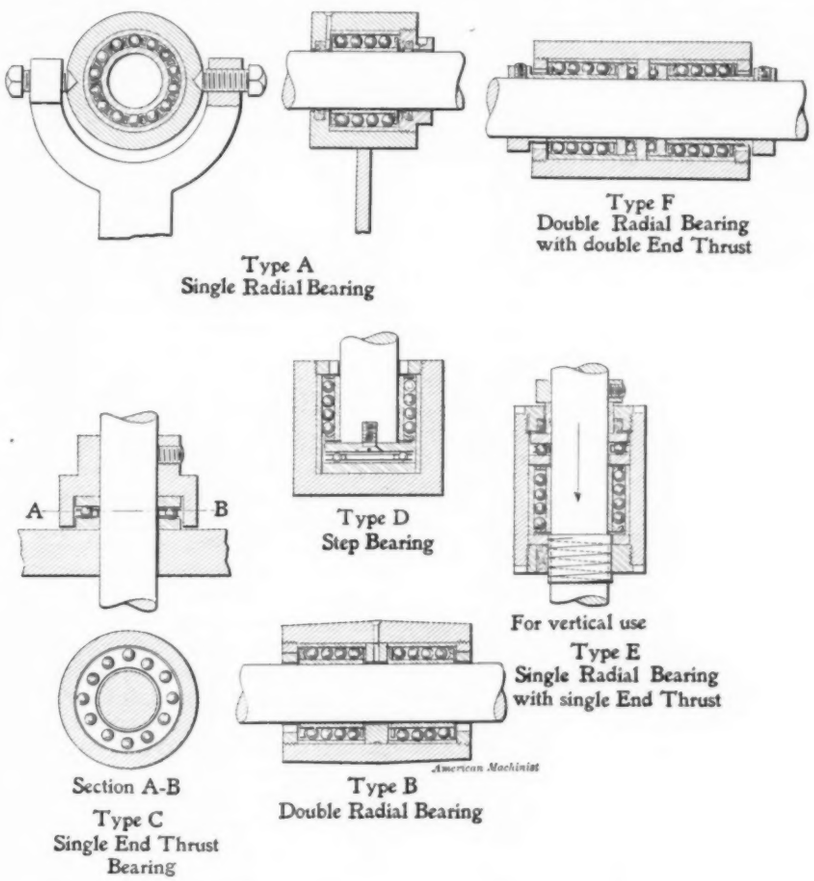
1. "That friction increased little if any with the increase of pressure," and

2. "That friction increased considerably less than in the proportion of the square root of the speed."

The tests were made with bearings 2⅛-inch and 2½-inch diameter, and each test lasted from one to two days. The co-efficient of friction developed was from .0025 to .005, and these figures were obtained under comparatively light loads.

The first of these conclusions indicates a conformity to the laws of fluid friction, and, in fact, agrees with late experiments with ordinary bearings working within ordinary working loads and with flooded lubrication. In comparing the ball bearings with babbitt bearings, it was found that under 200 pounds pressure per square inch and 800 revolutions per minute, babbitt bearings 2½-inch diameter, lubricated with twenty drops of oil per minute and having a half inch lateral play, heated badly. Under the same pressure, ball-bearings were run at 2,600 revolutions, or more than three times as fast, without signs of warming.

We give with this, sections of several different ball bearings as made by the company referred to. These will be readily understood from the drawings, though it may be well to call attention to the fact that thrust collars are not made an integral part of either box or shaft, but are held in place by the sleeves which abut against them on one or both sides. Taking "Type F," for instance, the central thrust collar does not revolve, but is held within the box by the box linings or hardened shells which are pressed against it from each end by the external collars shown, one in each end of the box. The other two thrust collars are kept in place by the shaft sleeve (also hardened steel, ground), and can be adjusted by the collars on the shaft shown outside the bearing. The same principles apply to the other bearings shown, or at least to those in which thrust is provided for. The balls for taking thrust are arranged as shown in "Type C."




▲ ▲ ▲

The Harlan & Hollingsworth Co., of Wilmington, Del., were the lowest bidders on a contract for the building, from the designs of A. Cary Smith, of New York, a new steam pilot boat which is to be used by the pilots of the Port of New York and will be of steel, 140 feet long, 24 feet beam and 11 feet draft, measuring somewhat over 300 tons displacement. The vessel will have about 14 knots speed, with a single screw propeller, and will be equipped with an electric search-light and all modern improvements. This will be the first steam pilot boat to go into service at the Port of New York.

▲ ▲ ▲

When it comes to the transformation of trades under the progress of modern invention, what change could be greater than that involved in setting the horse-shoeing, roadside blacksmith to repair a broken-down bicycle? And yet the country blacksmith probably has to come to it, or practically to master two trades instead of one.

▲ ▲ ▲

Mr. Louis E. Neustadt, who has been associated with the Gardner Governor Co. since 1878, died at Asheville, N. C., June 20th. At the time of his death Mr. Neustadt was secretary of the company named.

# ELECTRICAL MACHINERY.

## Machine Shop Practice in the Manufacture of Commutators.

BY E. L. HAYWARD.

### In Two Parts—Part II.

A hardwood clamp made as shown in Fig. 3 will hold the bars rigidly in place about the arbor. Having thus secured the bars on the arbor, put it in a lathe with a compound rest. After turning up the ends of the bars to the proper bevel, they are ready to lock into the sleeve. Turn up the sleeve according to drawing, and also the collar and nut. Spline the

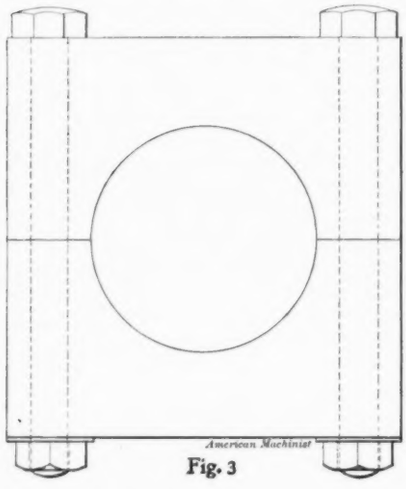


Fig. 3

collar to admit the "Dutchman" *K*, Fig. 1, which keeps the collar from turning on the sleeve. Do not omit to drill the vent holes in the sleeve so as to communicate with the compartments *o* and *p*, Fig. 1, for wet shellac is liable to accumulate there and prove troublesome to dry out.

The collars upon which the commutator bars rest now demand attention. They must be of insulating material, and there is no material that is really satisfactory. Micanite is too soft and yielding; hard rubber is too brittle, as is also slate. This insulation is in a most perilous position. It is confined between two metal surfaces which are liable at times to be intensely heated, and it is subjected to the destructive influence of vibration, which tends to reduce all such substances to a state of extreme brittleness and ultimately to a fine powder. In spite of all these difficulties it must support the commutator bars rigidly, for upon it the commutator depends for the preservation of its cylindricity. The writer has found that pressed fibre answers these requirements in a greater degree than any other substance. Like the micanite segments, it must be carefully inspected for bits of conducting substances. Thin fibre strips are too soft to be suitable. The ring must be turned off from the edge of a thick circular disk of fibre. Several such rings, side by side, will probably be necessary. The end collars may be of micanite and can be bought ready made. If, however, it is desired to make them, they may be built up of thin fibre and mica fastened together with shellac. By wetting, it may be made to assume its shape of a truncated cone by being pressed in a mold of the proper shape. Do not use the commutator for this purpose. The fibre will be found to retain its shape when dry. It may then be faced on both sides with pieces of mica and shellac, and when dry is ready for use. This commutator, it will be noted, requires two such rings.

Having prepared the insulating and metal parts substantially as described, the commutator may be assembled. Place one of the beveled collars on the sleeve and slip three of the fibre rings tightly against it. Give these pieces a light coat of shellac. Then place the middle and end rings on and shellac them together also. Stand the arbor carrying the bars on end, with the lugs uppermost, and loosen the wooden clamp. By a series of gentle taps the clamp and bars may be made to slide down to the bench, and upon the removal of the arbor will be left standing on the bench in a vertical position. The sleeve may now be let down inside the bars, for the shellac will hold the rings in place. The sleeve with its bars should now be placed in the lathe upon an arbor (it need not be driven tight), and on the arbor should be placed the end insulating collar, the beveled ring and the nut. Push the bars into their position on the sleeve and set up the nut at the end against the insulating collar and beveled ring. From this point on, the commutator should be tested with the

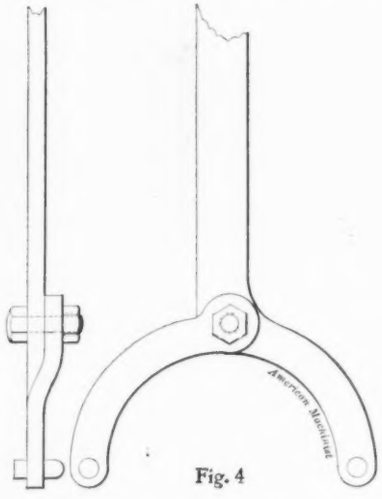


Fig. 4

magneto bell at every step. Now tighten the hardwood clamp as much as possible. This is an important point, for it settles the bars onto the fibre rings much more firmly than the end nut can do, no matter how tightly it may be set up. Now the arbor may be tightly driven into the sleeve and replaced in the lathe. By putting in the back gears and placing a spanner wrench in the holes provided, the handle may be allowed to rest against the lathe bed and the belt pulled by hand. This will set the nut up very tightly indeed. By alternately tightening first the wooden clamp and then the end nut, the bars will be worked down to a position that will be permanent. Fig. 4 shows a convenient spanner wrench for this purpose, devised by the writer. It consists of two forgings bolted together by a stout short bolt, as shown. Small bars of Stubs steel are driven in holes in the ends and fit into corresponding holes in the commutator nut. As the linkage is triangular, there is no force tending to turn the parts on the joint at the bolt, which carries merely a shearing stress. It will be found convenient to tighten the bolt when using; for if it be left loose, it will be inconvenient to adjust in the holes in the nut when changing the grip. When desirable to set

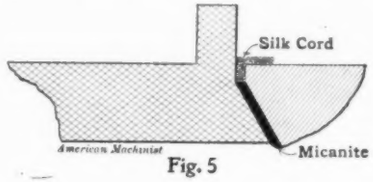


Fig. 5

to a new span, it is merely necessary to loosen the bolt and open the legs wider, or close them more nearly together, as may be required.

After setting up the commutator nut as tightly as possible, the commutator should be thoroughly baked. For small work like this, an ordinary oil stove and tin oven will answer admirably; if large work is to be done, such as baking out a large armature, an oven may be made of galvanized iron and several stoves used. The commutator should bake at least three or four days, both night and day. It should be kept at a temperature considerably hotter than the hand can bear. While it is at its hottest, it should be taken out and tightened, if possible. This does not take advantage of the expansion of the iron and copper, as many would think at first; but the insulation in its softened condition is more susceptible to being tightly bedded onto the bars. Unfortunately for this case, copper expands faster than iron, and heating tends to ultimately loosen the bars when the commutator is at a normal temperature.

After the commutator has had a thorough baking, remove it from the oven, and, mounting it upon the arbor, put it in the lathe again. Obtain some white skein silk and wind it into the groove just back of the lugs. Cover the last two layers with shellac, and see that the last layer overflows the groove and spreads for some distance over the head, as shown in Fig. 5. This will keep the dirt from bridging what would otherwise be a nar-

row gap from iron to copper. Shellacked whip-cord may be neatly wound over the edge of the beveled ring at the other end of the bars, for a similar reason. After this has been done and the shellac dried, the commutator may be turned and polished and the lugs faced up. Finish it as large as possible, regardless of drawing dimensions. The true machinist is liable to discredit this idea; but let him remember that the commutator in any event holds its size but a relatively short time. Throughout its life it will continually be worn or turned down. Shaping the running surface of a commutator to size is parallel to turning an inch or two off a grindstone in order to make it correspond with a drawing or order.

When the commutator is turned, tie a bare wire tightly around it so as to connect all the bars together, and test for grounds with the magneto. There may be a shellac ground that all the bars collectively will make sufficient to permit the magneto to ring through, where the partial ground of a single bar would not be apparent. This may be removed by subsequent baking. The commutator may now be considered complete, and should be kept carefully covered in a clean place till it is wanted.

▲ ▲ ▲

## Walker's Magnetic Chucks.

We present herewith a new electrical shop appliance that cannot fail to be of interest to our readers. It is an electro magnet of special design, and intended in its various forms to hold work for the lathe, planer, milling machine, etc.

Fig. 1 shows the form and appearance of the planer chuck. The magnetizing coil is of suitable resistance for incandescent lighting circuits, and the current is obtained by connecting the cable shown to the most convenient lamp socket. It is only necessary to lay the piece of work (which must, of course, be of iron or steel, as the non-magnetic properties of brass prevent the chuck being used with that metal) on the face of the chuck and turn the switch button, when the piece is anchored to the chuck with a force which almost defies separation. This force is, however, mostly downward, and to prevent the work from twisting on the chuck surface, adjustable edge and end stops are provided which, projecting slightly above the surface of the chuck, prevent the displacement of the work. These stops are, however, much more than the name would indicate. When the work is in contact with them they, in fact, form part of the magnetic circuit, and the piece of work is bound to them with great force. One of these edgewise stops contains binding screws, as will be seen, which are of further assistance when several pieces of a kind are chucked at the same time.

Fig. 2 shows the same idea as applied to a lathe chuck, the work to be done being the facing of a washer. In this case the form of stop shown with the planer chuck is not applicable, and a saw-toothed wedging piece is used which, bearing upon the edge of the washer, prevents its movement. In this connection it should be explained that the magnetic grip is sufficient to prevent bodily shifting of the piece, but not to prevent its twisting under the force of the cut, and hence this form of stop is found to answer the purpose.

Figs. 3 and 4 show the construction of the planer chuck, Fig. 3 being a plan and Fig. 4 a section on the line *A B* of Fig. 3. The central web *a a* is the magnet core around which the insulated wires are wound. The double saw-toothed flange

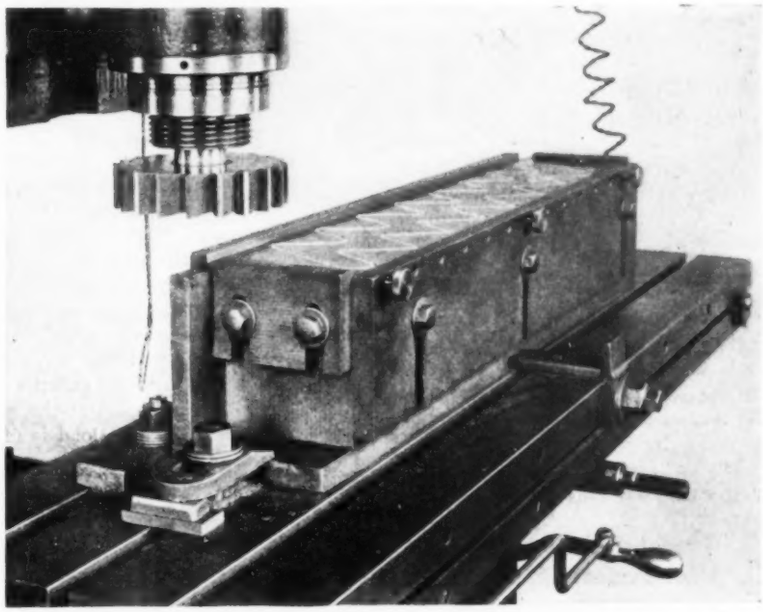


Fig. 1. PLANER OR MILLING-MACHINE CHUCK.

Fig. 2. LATHE CHUCK.

*b b b* is cast with this web and forms one of the pole pieces. The inverted box *c c* covers the parts described and is secured to the base of the web *a a*. The top of this box has a double saw-toothed opening, allowing the similarly-shaped pole piece *b b* to come up flush with the top of the box, and thus, with the top of the box, form the flat surface on which the work is laid. It will be seen that the saw-toothed flange *b b* forms one pole of the magnet, while the similar flanges *d d*, which project into the hollows of *b b*, form the opposite pole. The zig-zag space between forms the air gap, which is filled with some non-magnetic material, such as sulphur or babbitt. The piece of work, when laid on the chuck, bridges the air gap and forms the keeper of the magnet. Taking a section lengthwise of the chuck, a little way off the center line, will show that constant reversals of polarity take place, giving a fresh grip at each change.

The work being the keeper of the magnet, the grip once established is largely

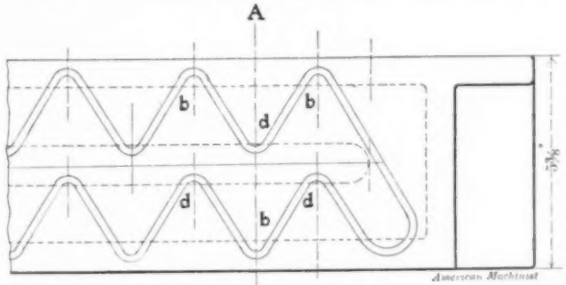



Fig. 3. Plan

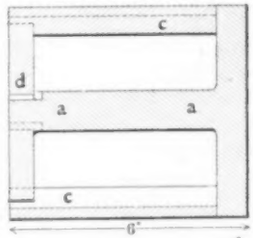



Fig. 4. Section on A-B

retained after the electric circuit is broken; and if the work does not involve too heavy cuts, the chuck may be used in this way with a large saving in the current consumed.

Our readers do not need to be told of the advantages of an appliance like this, which will hold any piece, no matter how thin or flat, without binding straps projecting above it. One useful application of it is to the holding of thin sheet metal for operation by a surface grinder. A feature which will be apparent to all is the positive holding-down of the work to the top surface, instead of the lifting tendency of many mechanical chucks which hold by an edgewise grip.

We have seen this chuck in operation, and can fully indorse it as a most useful device. We saw it in use on a Bucker vertical milling machine, as shown in one of the illustrations, and it showed no lack of holding power, as might, perhaps, be feared by some.

The chuck is the invention of Mr. O. S. Walker, of Worcester, Mass., who is making active preparations to place it on the market.

▲ ▲ ▲

## The Development of Electrical Industries.

Some remarkable figures have recently been published to show the extent of electrical development, from which we take the following:

There are in existence to-day 2,500 stations supplying arc lights, as many more supplying incandescent lights, and over 7,000 private plants. The capital invested in lighting companies is $325,000,000, and in private plants $200,000,000. The number of arc lights in use is over 250,000, and 75,000 incandescent lamps are manufactured per day. $100,000,000 are invested in electric mining machinery, and $60,000,000 in electrical motors for driving stationary machinery, the total number of electric motors in use for all purposes being believed to exceed 500,000. The electric elevator, which has hardly begun to attract public attention, is in use in this city alone to the number of 600.

The greatest single line of development is, of course, the electric railway, of which there are in existence to-day 12,000 miles of track equipped with 25,000 cars, and having a combined capital of over $700,000,000. The rate of investment in the various applications of electric power during the past nine years has been at the rate of $100,000,000 per year, while the total number of people who earn their livings in connection with the electrical industry is 2,500,000.

There seems to be no room for doubting that in this field this country leads the van—a fact which is fully recognized by foreign periodicals. We have about nine-tenths of all electric railways, while the use of the electric motor in other countries has scarcely begun. In electric lighting, both arc and incandescent, we are far ahead, while electric elevators are as yet scarcely known in Europe. It is probably true that there is more capital invested in the various electrical industries in this country than in all the rest of the world combined.

▲ ▲ ▲

One of the advantages of motor driving on the group system, as compared with individual motors applied to each machine, lies in the equalization of the load. A motor applied to one machine must be able to take care of the maximum load coming on the machine, and the excess of the maximum over the average load of one machine is often very large. With driving on the group system, the extra load due to a temporary heavy duty on one machine would, however, be a small percentage of the total due to the group, and not many machines of a group would call for their heaviest loads at the same time. In other words, the load is much more uniform. The fly-wheel effect of the line-shaft pulleys is also considerable, and protects the motor to some extent from violent fluctuations. From both causes it results that the surplus capacity in the motor required to meet occasional demands is less, and consequently a less horse-power of motor is necessary to do a given amount of work. A given horse-power can, of course, be had in one motor for less money than in several, which fact goes still further in reducing the cost of an installation on the group system.

▲ ▲ ▲

In a conversation with a leading builder of traveling cranes recently, the statement was made that within six months of the completion of their first successful electric traveling crane, inquiries for other styles of construction had practically ceased. As compared with the square-shaft or flying-rope type, the electric crane offers, first, greater mechanical simplicity, and secondly, much greater power. The amount of power which can be carried by a square shaft or flying rope is limited, and with cranes of large capacity the speed of hoist and traverse must be correspondingly slow, while with electric distribution the power which can be put into the crane is practically unlimited. Increased length of traverse, too, does not offer increased difficulties with electric distribution, and, in fact, electric cranes are in use of a length of traverse which would hardly be practicable with any other method.

▲ ▲ ▲

The new electric light plant at Norwich, Conn., was recently started for the first time, the throttle being operated by the wife of Mayor Osgood. There was a peculiar appropriateness in this, as just forty years ago this lady's father introduced illuminating gas into Norwich, and she, as a child, lighted the first gas jet.

# Letters from Practical Men.

## The Navy Engineers.

Editor American Machinist:

The inclosed clipping is from the New York "Herald," of Sunday, July 5th:

"As Congress has adjourned and as, therefore, no change in the laws governing the personnel of the navy can be made for several months at least, those officers of the service who are rabid about the differences between the line and the staff might do well to let their tongues and pens take a rest on this subject.

"It is greatly to be regretted that these differences exist. It is equally unfortunate that some of the enthusiasts of one corps [the engineer] should have sought to work up an influence outside of the service and inaugurate a campaign of agitation among civilians and politicians to achieve their ends.

"But it would be the part of common sense, especially in these days of summer heat, to refrain from further controversy, and it is therefore to be hoped that Secretary Herbert will not discipline the offending officers.

"He might wisely let them know, however, that further public discussion of line and staff troubles is objectionable and will not influence the Navy Department in their favor."

The "Herald" says "it is greatly to be regretted that these differences exist," which is very true; but if it is also true, as the "Herald" suggests, "that further public discussion of line and staff troubles is objectionable and will not influence the Navy Department in their favor," how can the engineers obtain their reasonable rights except by "agitation among civilians [who pay the taxes and own the ships] and politicians" [who make the laws]?

I hold that the engineers are doing no more than their duty in calling the attention of the ship-owners to the low condition of their engine departments, upon which the life of the ships depends, although "objectionable" to "the Navy Department"—hoodwinked as it constantly is, by the "bosses" in the line.

The "Herald" says it is "to be hoped that the Secretary will not discipline the offending officers." Let us all "hope" so, for the sake of the "Secretary." There is sometimes such a thing as "disciplining" secretaries; a secretary once "disciplined" me, and I had the pleasure of living to see him relegated to private life, stripped of his ill-gotten gains, and reduced to his normal condition of an old "soak."

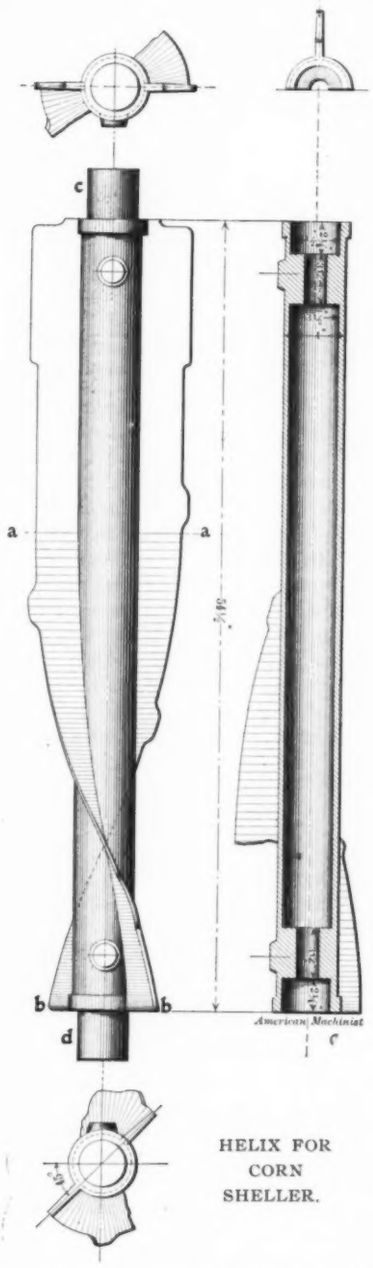
I expect in the next Congress—subject to the usual political uncertainties—to have a small influence which will be directed toward looking after these disciplinerers and their advisers.

WILLIAM H. HARRISON.
Formerly Engineer, U. S. Navy.
Braintree, Mass.

## How to Mold It.

Editor American Machinist:

I send you herewith a drawing of a helix we are making for a corn sheller; I would like to have you, or some of your contributors who are foundrymen, tell us how to mold it. The spiral part of the wings from *a* to *b* makes a curve of 135 degrees, and in order to get the pattern out of the mold, the sand must be removed from either one side or the other of the spiral part of the wings. What we want to know is how to make a flask and how to part it for this job.




HELIX FOR CORN SHELLER.

We accomplished the task in two ways, and if you desire I will explain how, after we hear from you; *c* and *d* are, of course, core prints.

EZRA ESTEP.

Sandwich, Ill.

## The Revolution Mark in Milling.

Editor American Machinist:

In several articles you have published on milling I have seen the "revolution mark" mentioned, but never recollect having seen a satisfactory reason given for its existence. Can any of your readers say why a perfectly true cutter, revolving without vibration, with the work fed continuously forward, should produce one mark for every revolution? I have made two tests on cutting keyways 1¾ inches wide, ⅜ inch deep, in a steel shaft 7 inches diameter. The cutter used had teeth on top cut at an angle to axis, and was also cut at sides. It was finished by grinding perfectly true on its own spindle. There was not the least vibration, and the work-table was fed continuously forward by a screw. The particulars of the experiments were as follows:

| | No. 1. | No. 2. |
|---|---|---|
| Revolutions of spindle per minute | 13.25 | 13.25 |
| Traverse per minute | 2.5 | 1.25 |
| Diameter of cutter | 6.75 | 6.75 |
| Number of teeth | 47 | 47 |
| Diameter of cutter spindle | 2.75 | 2.75 |
| Feet per minute on periphery | 23.4 | 23.4 |
| Width of cut | 1¾" | 1¾" |
| Depth of cut | ⅜" | ⅜" |

My first experiment was with 2½-inch traverse, giving one mark for every revolution of cutter. I then reduced the traverse one-half, keeping the periphery speed of cutter the same, and this, of course, reduced the revolution mark by one-half. It would thus seem that, by increasing the periphery speed considerably, we should be able to practically eliminate the revolution mark, but should be reduced to a very slow traverse. What I would more particularly like to ask you is, whether you can give any reason for this mark. Everything during the experiment was perfectly rigid, and the cutter seemed to cut beautifully.

HERBERT MARSHALL.

Gainsborough, England.

▲ ▲ ▲

## Holding Piston Rods—The Security of Tight, Straight Fits.

Editor American Machinist:

Mr. Bullock's test shows that keying a rod is a good way to hold it, and one of the best features about it is that it is not so treacherous as the screwed rod. Mr. Bullock says the key was driven lightly. If the key had been driven tightly, it would easily have exceeded the strain that the others failed with. When the key is tightly driven, the friction of the rod in the crosshead is usually more than enough to resist the steam pressure, and so long as that is the case there is no possible chance for the rod to work loose.

Straight piston fits have been a miserable failure in locomotive practice, and usually locomotive men get more work out of a given size rod than anyone else. Mr. Johnson advocates the straight, loose fit in the piston, and brands the taper fit as a relic of barbarism. Age is no objection to a good thing, but barbarism is objectionable in even a new thing. We have two engines with the fit he advocates, and they never would stay tight until new rods were pressed in tight, and they now hold by friction. We recently received another engine from the same company, and all its fits are taper. This experience is strictly in line with what has developed in the various letters on Keying and Key-seats, and also with what the "American Machinist" says in the article on Hollow Shafting, July 2d.

Nearly all the street car motors drive the axle through a split gear and a key. When the gear had only four bolts it was almost impossible to keep them tight. Three years ago we made all the gears solid and pressed them tight on the axle without any key, and they stay there and give better service because they are true. The latest motors have taper seats for the pinion and also for the commutator. They also have keys; but if the parts were put on tight they would be better and cheaper without the key. We press all pinions on tight, and remove the worn-out ones by nicking them between the teeth with a chisel, as they are quickly expanded so they will slide off. In several other things we have abandoned the fastenings and shrink or press the parts together, and so long as the parts are the proper size before being put together they never come loose.

T. ELLIOTT.

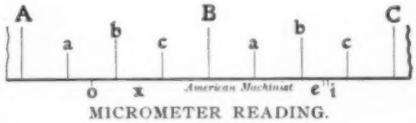
Atlanta, Ga.

▲ ▲ ▲

## Micrometer Readings.

Editor American Machinist:

Mr. Hugh Dolnar is so minute and exhaustive, and evidently so conscientious, in his accounts of the means and methods of bicycle construction, that I feel that he must certainly thank me for calling his attention to a slight error of statement in his last article. In his account of the measuring of the balls, June 25th, he says that "if they are sorted to the nearest $\frac{1}{1000}$ inch, the diameter variation is, of course, less than $\frac{1}{1000}$ inch." Now, how can this be so? Here is a little sketch that shows how it looks to me. Suppose the distance from *A* to *B*, or from *B* to *C*, to be $\frac{1}{1000}$ inch, then the distance from *a* to *b* or from *b* to *c* will be $\frac{1}{1000}$ inch. Now, in measuring the balls, if the measurement of one came to *o* and that of another came to *x*, they would both have the same nominal diameter; they would both be credited to *b*, and it seems to me that instead of the difference being less than $\frac{1}{1000}$, it




MICROMETER READING.

would be pretty near $\frac{1}{4000}$, and, in fact, the difference could be anything quite up to $\frac{1}{4000}$.

Of course, the practice of measuring the balls, by the micrometer, and of sorting them out by that means, is an excellent one, and I do not know how to suggest a better way; but it is still far enough from perfection. One curious fact is that after the most careful sorting by this method, balls of different nominal sizes may be nearer the same size than balls of the same nominal size. Suppose the measure of a ball to come to *e* and that of another to *i*, one will be credited to *b* and the other to *c;* but they will be much nearer the same size than the first two, *o* and *x*, referred to above, which were both credited to *b*. I never expected to get down to such fine work as this, and I am duly thankful to Mr. Dolnar for having led me so far.

TECUMSEH SWIFT.

▲ ▲ ▲

## Tensile Test of Piston-Rod Fastenings.

Editor American Machinist:

The late lamented Shah of Persia never cared to attend a horse-race, because he knew beforehand that one horse was faster than another. Mr. Bullock has been to the trouble and expense of preparing a number of pieces of iron assumed to represent different styles of piston-rod fastenings, and has had them officially pulled apart with conclusions as inconclusive as those of any horse-race. I do not here allude to the fact that Mr. Bullock failed to mention the diameters of the rods tested, although it would have been proper to have told us that. The test showed that the tension of the jam nut increased the tensile strain on the rod at the point where it came in contact with the crosshead, but that did not require testing, because every mechanic knows it, and should be able to satisfy himself on the point by pure reason and without resort to experiment. When I asserted the contrary I was, of course, entirely wrong. Mr. Bullock should not represent me as an advocate of the jam nut, for I certainly am not. In my letter I distinctly said that "I do not believe there is any place whatever where a jam nut is used that is not more or less objectionable."

It will remembered that a few weeks ago, April 2d, Mr. Bullock described in the columns of the "American Machinist" a mode which he had adopted for fastening a piston rod in the crosshead of a steam engine, and that I objected to it as in many respects improper. I did not hint that lack of tensile strength was one of the objections.

Mr. Bullock first bored the hole in the crosshead taper, or at least a taper thread was cut in it, and he did not tell us how he did that nice little job; then a taper thread was cut on the end of the rod to fit the thread in the hole; the size of the thread was such that there was a square shoulder of $\frac{1}{16}$ inch all around the rod bearing against the crosshead, besides the fit of the taper threads. The rod end was turned straight and $\frac{1}{8}$ inch less than the full size, and then the taper thread was cut on it so that as it approached the shoulder the tops of the threads were flatted off, and right at the shoulder the thread was very much truncated, while the thread in the crosshead must, of course, have been full and sharp. After all this, a deep hole was drilled in the end of the rod; it was tapped with a taper pipe tap; two cross slits at right angles to each other were cut longitudinally for a considerable depth into the rod; and after it was screwed home in the crosshead, a taper plug was screwed into the pipe-tapped hole, distending the end of the rod, and, as was claimed, fastening it securely.

Now, my objections were based on the difficulty of getting perfect fits on the whole length of the taper threads at the precise time the "one correct length" was reached; on the difficulty or impossibility of knowing whether the threads did actually fit or not; on the inadequacy of the $\frac{1}{16}$ inch shoulder for withstanding the pounding of the engine; on the mutilation of the end of the rod by the tapped pole and the long slits; on the insufficiency of pressure that could be afforded by the taper plug; on its applying that tightening pressure only at the extreme end of the rod, etc. I think the fastening costly and uncertain in the making, and likely to get slack by the crushing of the metals in contact after running some time; but I should not expect the rod to give out because the dead pull was ever too great for it.

TECUMSEH SWIFT.

▲ ▲ ▲

## Alteration of Adhesion of a Locomotive by Change of Direction of Motion.

Editor American Machinist:

In answering Question No. 7 on January 9th, you say: "As a general thing, a locomotive will pull as much one way as the other." It is my impression that this is too often regarded as true. The rule certainly does not apply in the ordinary American road locomotive, although it will apply to most switch engines and to many European locomotives.

What a dray horse can draw will depend on his muscular strength so long as he has a sure footing, but when his footing fails him his great strength is of little use. So what a locomotive will draw will depend upon the power of the engines until the drivers slip on the rails, and if the engines are powerful enough to do more than this—and they often are—then may we not say that the load which it will draw will depend upon the tractive force of the drivers on the rails. The tractive force depends upon the weight on the drivers as well as the condition of the track. And I expect to show that the effective load on the drivers of an American road locomotive, will depend somewhat on the direction it is pulling.

To illustrate, let us take a box resting on a level floor and apply a horizontal force at the upper corner. If the box adheres to the floor well, it may be made to rest on one lower corner, as shown in Fig. 1. In any case, more weight will come on the corner *m* when the force *P* is acting than when it is not. And in no

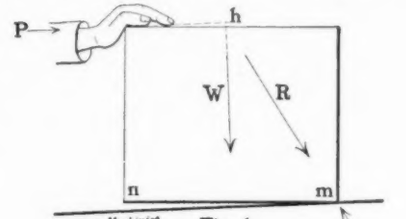



Fig. 1

ALTERATION OF ADHESION.

case can the force *P* be greater than that required to slide the box along.

If, now, we take this box and place it on a truck, as shown in Fig. 2, and apply a force *P* at the upper corner until the truck slides, and again a force $P_1$ in the opposite direction, we will observe quite a difference in the two forces required to move the box in the opposite directions. For in one case most of the weight rests on the feet, while in the other most of the box rests on the truck wheels.

From Fig. 2 it is evident that, in a locomotive of the American type, with

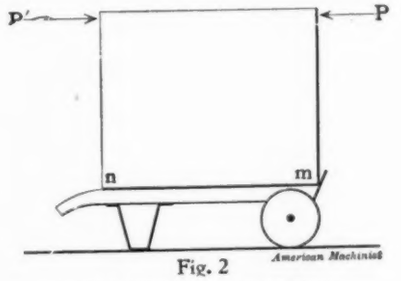



Fig. 2

ALTERATION OF ADHESION.

a portion of the weight on pony trucks in front and the remaining weight on the drivers, the effect of the train pull at the drawbar and the resistance at the rail is to throw additional load on the drivers when pulling forward and to lessen their load in backing.

In Fig. 1, the forces acting are the push *P*, the weight *W* and the reaction of the floor *r*. Combining the forces *P* and *W*, we get the resultant *R*, which always passes through the point of intersection *h*, and, when the box rests entirely on one corner, as shown in Fig. 1, this resultant will pass through the corner *m* and be equal, opposite and in the same straight line as the resistance *r*. In case the adhe-

sion of the box to the floor is not great enough to sustain the box on one corner $m$, as shown, then the force $P$ will be less, and the resultant will pass from $h$ to some point inside of the corner $m$; and as the box rests on the two corners, there will be a reacting force at each corner $m$ and $n$, whose combined action is equal and opposite to $R$. If the friction at each corner is the same, these two forces will be parallel to each other and to $R$. If, as in case of Fig. 2, the friction at $m$ is almost nothing, the reaction of the floor at $m$ will be in a line nearly vertical, and the reaction at $n$ necessarily more oblique than $R$. For in all cases $R$ is equal to and opposite to the combined forces at $m$ and $n$.

To apply the foregoing to a locomotive, let us take the case represented by Fig. 3, in which the weight on drivers is 80,000 pounds; weight on trucks, 30,000 pounds; diameter of drivers, 68 inches. Distance

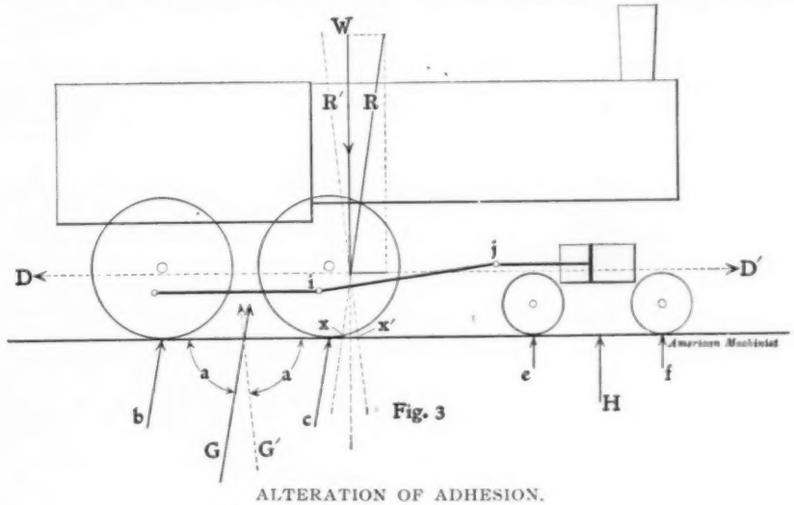



Fig. 3

ALTERATION OF ADHESION.

from center to center driver axles, 84 inches; from center to center truck axles, 68 inches; from front driver to rear truck axle, 86 inches. Length of connecting rod, 101 inches; height of drawbar, 32 inches; cylinder, 19 inches diameter by 24 inches stroke, and boiler pressure about 180 pounds.

Remembering that in any case the external forces on a body are the only ones that disturb its equilibrium, we will consider the external forces in Fig. 3 which are—the weight of the entire locomotive $W$, the train pull at the drawbar $D$, and the reaction of the rails on the wheels $b$ $c$ $e$ and $f$.

From the weights on drivers and trucks we locate the center of gravity at $W$, and if we knew the magnitude of $D$ we might construct a parallelogram of forces and find $R$. But as $D$ depends on the weight on drivers, and the weight on drivers depends in part on the magnitude of $D$, we will commence at the rail forces $b$ $c$. We may assume that the forces $b$ and $c$ act parallel to each other, and combine them into one resultant $G$ (due account being taken of the obliquity of connecting rod making the load at $c$ slightly greater than at $b$ when pulling forward, and less in backing). The condition of the rails will determine the least angle $a$ that the force $G$ may make with rails. For an average condition of rails, take the direction of $G$, such that the horizontal component is one-seventh of the vertical. Taking this as the location and direction of the force $G$, and without knowing its magnitude, and assuming $H$ to be vertical and midway between $e$ and $f$, we may extend these lines upward until they meet, and from this meeting-point draw a line through the intersection of $D$ and $W$, and this will be the direction of resultant $R$. Then, having the direction of $R$ and $D$, and the magnitude and direction of $W$, we simply construct a parallelogram with $W$ as one side and get the magnitudes of $R$ and $D$.

Going through the same process for the locomotive pulling backward, we take the direction of the force $G$, making the same angle $a$ with the rail and find $R^1$ and $D^1$, by extending line $G^1$ downward until it meets $H$.

Extending the lines $R$ and $R^1$, we find that they intersect the rails at $X$ and $X^1$, respectively; and as $X^1$ is farther to the right than $X$, the effective load must be some 7 inches farther forward when the locomotive is backing than when pulling forward, and hence the tractive force somewhere near 5 per cent. greater when pulling forward than when backing.

An eminent writer on this subject solves this problem by taking into account various internal forces, which are, of course, only another aspect of the external ones and lead to the same results.

In the case of mogul and consolidation locomotives, the difference between the forward and backward pull becomes much less as the forward driver takes the place of the rear truck wheel. Also, in locomotives with a long wheel base the difference is less. Probably the case shown in Fig. 3 gives very near a maximum difference of pull.

JOHN D. RIGGS.

Janesville, Wis.

## The Business Side of Special Fixtures.

Editor American Machinist:

I was very much interested in your editorial touching the cost of special tools. There can be no doubt that special tool work is often overdone, but there is one consideration which counts in favor of such appliances to which you make no reference, and which I will explain by recounting a piece of personal experience.

I once had charge of the organization of a shop for the production of a certain specialty. The shop was new from the ground up, "out of the whole cloth," with every tool bought for its intended purpose. Under these circumstances I indulged myself quite liberally in a mechanic's natural partiality for special fixtures. On the books, these fixtures stand for the expenditure of a good deal of money; but I have no hesitation in saying that, had the shop been organized on the old-fashioned basis, the production per tool would have been so much less that enough more tools would have been required for the same output as to have absorbed at least as much money. In other words, the fixtures did not represent any additional outlay. The question was not one of increased outlay offset by cheapened production, but simply whether a given amount of money should be so used as to secure cheap production, or the reverse.

This consideration applies to all special fixtures. In so far as such fixtures increase the output of the lathes of the shop, for example, they, sooner or later, save the purchase of additional lathes. Not only this, but they save the provision of additional room for the lathes, and additional power and superintendence.

This is a many sided question on which no one has a right to speak dogmatically, and while I fully agree with the general form of the rule which you publish, it seems to me that the considerations outlined above should lead to a lengthening of the time allowed for a fixture to earn its cost, especially in a fairly permanent business. The same principle applies to machines intended for special purposes and to improved tools, such as turret lathes and the like, as well as to special fixtures. With such tools there can be no doubt that the time limit should be extended. The risk of failure and of being superseded does not exist with them, and they are justifiable up to the point where they earn interest and depreciation.

I hope we shall hear from many of your readers on this subject. It is certainly one which has in the past received far less attention than it deserves.

SUPERINTENDENT.

▲ ▲ ▲

According to the Railroad Commissioners of New York, 94 per cent. of the street railways of this State are now operated by electricity.

# American Machinist.

Published every Thursday
by the

American Machinist Publishing Co.,
256 Broadway, New York.

Angus Sinclair, Pres't. John A. Hill, Treas.
C. A. Hansmann, Sec'y.

C. P. Day, Manager Adv. Dept.

Fred J. Miller, Editor.

Frank Richards,
F. A. Halsey,
Edward P. Buffet,
} Associate Editors.

A. L. Donnell, Dept. of Illustration.

▲ ▲ ▲

*Space in advertising pages only is for sale.*

*We invite correspondence on subjects pertaining to machinery.*

*Name and address must always be given, though not necessarily published.*

*Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.*

*Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

▲ ▲ ▲

SUBSCRIPTION PRICE:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.

No back numbers beyond 1895.


▲ ▲ ▲

## Marine Engineering Possibilities.

The field of invention is nowhere more attractive than in that portion of it which relates to marine engineering. The thousands of ships which plough the waters of the world to-day, and which represent such a vast aggregation of money and human experience, are, each of them, subject to improvement; and, in all probability, not one of them will ever be duplicated.

While some changes are made in the design and methods of construction of the hulls, yet the greatest part of the evolutionary progress occurs in the domain of steam engineering. The boiler question is gradually being solved, and it seems quite probable that only a couple of years more will be needed for the triumph of the water-tube type. The saving of weight will not, however, be as great as the extremists have clamored for; practical engineers having very generally conceded the value of a good supply of water, either in the boiler itself or in a convenient feed tank.

It is to be hoped, for many reasons, that the next problem to be solved in connection with marine boilers will be that of mechanical stoking. Mechanical stokers have been tried at sea, but never with the persistency and on the large scale that have given the water-tube boiler such a favorable recognition. Owing to the trying conditions that sometimes exist in a fire-room at sea, it would seem that a stoker of the underfeed type is the one from which most may be expected. Still, steam engineering is full of surprises, and it may be that some other style of device will meet with success.

Should mechanical stoking become a possibility at sea, there should be no loss of time in devising a simple and durable apparatus for feeding the coal direct from the ship's bunkers to the stokers with a minimum of man-handling. Thus equipped, a steamer could go to sea with only a few men in the fire-rooms to tend water, do the necessary cleaning up, and make repairs in case of a break-down. If the boiler plant be divided into a sufficient number of units, it is unnecessary to stipulate that the furnaces shall be conveniently arranged for hand-firing in case of the failure of a stoker.

In the engine-room the weights of the moving parts have already been so much scaled down, that there appears to be little hope of any great reduction of weight per horse-power. Nevertheless, with the higher steam pressures that we may expect with the adoption of tubular boilers, and with the higher continuous speeds that will result from improved methods of lubrication, the weight reduction will be worth striving for.

The system of lubrication which we see every day in a bolt-cutting machine is one that suggests an application of its principles to steam engines of every sort, and especially to marine machinery. With the streams of lubricant playing on all the important bearings, the marine engineer could look down from his platform and gaze upon the flying parts with no misgivings as to the results of that last opening of the throttle—provided always that he could be perfectly assured of the cleanliness of those torrents of lubricant pumped from the bilges. And there's the rub. The daily cleansing of a few gallons of oil in a shop on shore is a matter of easy accomplishment, but the task of purifying the hundreds of gallons per day that would be required by an Atlantic liner is somewhat different. The saving in oil bills would be worth considering, however; and we think marine engineers may look forward to a condition of things which will be materially better for them, both in the fire-rooms and in the engine rooms.

▲ ▲ ▲

## The Value of Reputation in Machine Tool Building.

In conversation recently with a representative of one of the oldest and most highly respected machine tool building houses of this country, the startling statement was made by him that, in the United States alone, reputation was of no value in this line of business. Said this gentleman: "Instead of our experience being of value to us in a business sense, it is, in fact, the reverse. Were we to deliberately advertise the length of time we have been engaged in building tools, it would not attract but repel trade. The constant tendency here is not to patronize the old houses, but the newest and least experienced—especially if they make the most noise." The tendency here, according to this gentleman, is to connect age with old-fogyism, and this, together with a feeling in favor of "giving the new house a chance," regardless of how satisfactory the goods of an old house may have proven, places the older concerns at a positive disadvantage. Said this gentleman: "There is a certain manufacturing concern (also long established) whom we have for years supplied with many of their tools. The only complaint we ever had from them was, that each new tool was so much in advance of the previous ones as to make the old ones unsatisfactory by comparison; and yet the directors deliberately went to the superintendent and asked him why he bought so many tools of us, and practically compelled him to buy elsewhere in order to divide up the trade. Now, what is the use of our endeavoring to excel or to satisfy customers if, after making sales, preference is to be given in the next trade to someone else regardless of our own record?"

There is, we are convinced, a certain amount of truth in the above statements, albeit, in contradiction to them, some of the oldest machine tool houses in the country are to-day among the most prosperous, although very likely their continued prosperity is more due to constant "hustle" on their part than to reputation pure and simple. On the one hand it should be a matter for congratulation that new houses find it comparatively easy to secure a foothold in our markets, but on the other we think it an undoubted fact that reputation has too little value among us, which must necessarily lead to a loss of ambition to acquire a reputation, as so pointedly instanced in the conversation referred to. In England, we are assured, tool builders have regular customers whom they have supplied with tools for generations, and the policy is to buy at the same places as long as the goods are satisfactory in quality and price. In this, apparently, English buyers go as far to one extreme as we do to the other. If our policy fails to properly reward a tool builder for excellence, the English policy must fail equally by withholding that incentive to constant exertion which comes from competition. A tool builder should no more be allowed by his customers to sit down in complacent knowledge that his business is securely based on former performance than he should be forced to feel that experience and ignorance are on a par in the purchaser's estimation. At bottom, the fault in both cases is a lack of study of the quality of the goods. Were more tools bought for their excellence, instead of from their photographs and prices, neither old nor young houses would have cause for complaint.

## A Combination.

A subscriber writes us as follows: "I am one of your oldest readers, and if you will look over your books you will find I was one of your first subscribers. I am now getting the 'American Machinist' from a man who used to work in our shop and lost one of his hands on a circular saw. I wish to help him along, and that is why I am not at present a subscriber." That is all right. Readers are what we are after most of all, and we are glad to know that an unfortunate mechanic can help us and help himself at the same time. This threefold mechanical combination—the mechanics behind the paper, the mechanic selling the paper, and the mechanic buying and reading the paper—is a good one and should flourish in many places.

▲ ▲ ▲

The Western Iowa Railway has been incorporated, and is to run from Hartley to Sioux City. It is called a "Populist road," and the articles of incorporation prohibit the payment of more than $2,400 salary to any official, which, of course, means that the road will never have an official worth more than that amount, no matter how badly a first-rate man might some day be needed.

▲ ▲ ▲

At last the long-delayed medals have been received by exhibitors at Chicago, and large numbers of our friends have sent us notices to that effect, together with copies of the awards—all for publication in our columns. We must beg to be excused; there is not room for them, and our readers are not interested in them.

▲ ▲ ▲

## Literary Notes.

THE WISCONSIN ENGINEER, Vol. I, No. 1; quarterly. Issued by the engineering students of the University of Wisconsin. Madison, Wis.

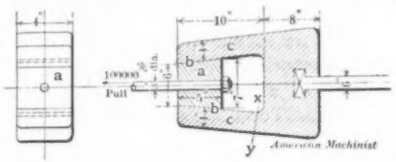
No single fact illustrates more forcibly the growth of engineering education in this country than the multiplication of engineering periodicals published by the engineering schools, of which this is the latest addition. It is extremely well gotten up from the printer's standpoint, and will no doubt be of appreciable value to the university. It of course represents all the departments of engineering maintained at the university, and contains articles on mechanical, civil and electrical engineering subjects. It shows the usual bias of such publications toward measurements, tests and mathematics.

The "Mill and Shop Journal" is a new publication which hails from Boston and is published by T. Oliver Dowd. The new paper devotes itself especially to textile manufacturing interests and is a "trade paper" rather than a technical one. As such it is a vigorous and enterprising journal of 64 pages, 8⅜ x 11½ inches.

# Questions and Answers.

**Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.**

(132) W. B., Johnstown, Pa., asks: What pressure will wedge *a* exert upon surface *b*, tending to break jaws off at *x y*, having a pull of 100,000 pounds on wedge *a* in the direction shown by arrow? A.—There is a very simple method of solving all such problems as the above if we only remember that, barring friction, the force with which any portion of a mechanism moves is inversely proportioned to its




rate of movement. In the above case, if we assume that the wedge *a* is moved within the jaws a distance equal to its length (5 inches), it will have moved the jaws apart 1 inch; and as the movement of the jaws is one-fifth that of the wedge, the force with which they will be moved is five times the pull on *a*, or 500,000 pounds. Of course, the frictional resistance between the surfaces of *a* and the jaws will modify this; its amount will depend upon the materials used, and in some cases also upon the amount of surface to which the pressure is applied, though, of course, this latter does not affect the result until the pressure per unit of area becomes so great as to alter the co-efficient of friction.

(133) Want, New York City, writes: We have a boiler that is much overloaded; can you tell me how to figure the horse-power? The boiler is horizontal tubular, 5 feet diameter and 16 feet long, with eighty-four 3-inch tubes. The grate is 5′ x 5′ 6″ and a blower is used. Steam pressure from 70 to 90 pounds. The engine is 14 x 30 inches and runs at 80 revolutions per minute, and it is overloaded. If steam gets down to 70 pounds, there is no cut-off. Besides this, live steam is used through the shop. Two tons of good coal are used per day. Will you give me a formula to find the horse-power of a boiler forced like this one? A.—We cannot give a formula for such a case as this. About all that we can do is to figure a little upon what the boiler might do under fairly good conditions and guess at the rest. The heating surface will be: First, for one-half the shell, $5 \times 3.1416 \times 16 \times ½ = 125.664$ square feet, and for the tubes $3 \times 3.1416 \times 16 \times 84 \div 12 = 1,055.57$ square feet, and $1,055.57 + 125.664 = 1,181$ square feet; and as the grate surface is $5 \times 5½ = 27.5$ square feet, the heating surface will be: $1,181 \div 27.5 = 42.9$ times the grate surface. The indicated horse-power of the engine will be, with, say, 65 pounds mean effective pressure: $14^2 \times .7854 \times 65 \times 5 \times 80 \div 33,000 = 121.28$ horse-power. The steam consumption, at 70 pounds pressure and the valve closing at, say, .9 stroke, will be: $14^2 \times .7854 \times .9 \times 5 \times 80 \div 144 = 384.846$ cubic feet per minute $= 384.846 \times 60 = 23,090.76$ cubic feet per hour. As a cubic foot of steam at 70 pounds weighs .198 pound, the water per hour will be: $23,090.76 \times .198 = 4,571.97$ pounds. To this one-third should be added for clearance and for losses which are never accounted for, and we then have $4,571.97 + 1,523.99 = 6,096$ pounds. The boiler having 27.5 square feet of grate surface, and burning, say, 15 pounds of coal per hour per square foot of grate and evaporating 8 pounds of water per pound of coal, would exaporate $27.5 \times 15 \times 8 = 3,300$ pounds of water per hour, or only a little over one-half the quantity required, so that the necessity of using the blower and crowding the fire is evident enough. But it is to be noticed that, if burning only 15 pounds per square foot per hour, the weight burned would be $27.5 \times 15 = 412.5$ pounds per hour, or 4,125 pounds per ten hours of steady running. It seems quite evident that our correspondent's data must be incorrect in some respects. Either more coal is burned than he states, or there must be a cut-off at least as early as half stroke, or both.

▲ ▲ ▲

# Business Specials.

**Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.**

Grant Gear Works removed to Boston—See p. 26.

1896 Catalog just out. Boston Gear Works.

Forming Lathes, Mer. Mach. Tool Co., Meriden, C.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Honest Mach. Oils. F. S. Pease Oil Co., Buffalo, N. Y.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Aluminum and Brass Castings, Machinery Name Plates. Twining Campbell, Paterson, N. J.

Presses and dies for bar and sheet metal work. Ferracute Machine Company, Bridgeton, N. J.

Just Issued—Catalog No. 8. Mailed free. Clayton Air Compressor Works, 28 Cortlandt st., New York.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Form'g and reliev'g lathes for back'g off formed cutters; gear cutters for cutting 2 teeth at a time, any pitch, 2 to 48. R. M. Clough, New Haven, Ct.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

For Sale or Rent—Foundry and Machine Shop with additional land; in good condition and well equipped for medium heavy work. Capacity of foundry, seven tons per day. Located on railroad within eight miles of New York. Terms easy. Call or address, Room 41, 22 William st., N. Y.

▲ ▲ ▲

## Charges Against Chief Engineer Melville.

The "Army and Navy Journal" of July 4th says:

"The controversy between the line and staff has culminated in the filing of charges against Engineer-in-Chief Geo. W. Melville by Capt. Philip H. Cooper, the Superintendent of the Naval Academy. These charges were received at the department some weeks ago from the Naval Academy, and have since been buried in the Secretary's office, the Secretary showing no disposition whatever to give them consideration. It is understood that the charges are based upon the article written by the Engineer-in-Chief in the 'North American Review,' entitled 'The Engineer in Naval Warfare,' in which he made some statements in regard to the engineer cadets at the academy. These were taken exception to by the Superintendent, with the result that he forwarded a letter to the department in regard to them. A synopsis of the article complained of appeared in the 'Journal' of May 9th, page 647. In it

the Engineer-in-Chief said: 'Annapolis is either unable or unwilling to train naval engineers, and if its work is brought into comparison with that of other institutions, the Naval Academy will be compelled to extend its engineering curriculum or show cause for its existence.'"

This, of course, means simply that the Superintendent of the Annapolis Academy is trying to make things uncomfortable for Commodore Melville, because the latter has stated in very mild language a small part of the truth about the academy. If, now, Commodore Melville were Chief Engineer on board ship, and the Superintendent were Captain of that ship, charges would not be thought of, but instead of them life would be made a burden for this critic of line doings, and it would all be done with the rules and regulations.

▲ ▲ ▲

## Metrological Standards and Gaging Implements.

Mr. John Richards has delivered at Leland Stanford University a lecture on the above subject, from which we abstract as follows:

* * * "The true standard in this country is the meter, legalized in July, 1866, decimally divided downward to the millimeter, and with multiples upward the same, to the myriameter, but by custom, and following the British measures, our machine work is mainly with measures corresponding to divisions of a yard, with divisions downward of three and twelve, as before remarked, stopping at an inch, which is twenty times too large for convenience, and going up by factors of 5½, 40 and 8 to a mile, all of which is as absurd as it is inconvenient.

"Other measures of weight, capacity, surfaces, solids, and so on, are as bad or worse, because we have two standards for weight and two for capacity, both in common use, divided in a manner that conforms to no conceivable system of order or relevancy, and explainable only on the grounds of accident, dating from a time and from circumstances that have nothing to do with modern methods—a tradition that would be out of place in the realms of imagination, to say nothing of the exact arts and sciences of our time. * * *

"In 1860, when my connection with this matter began, there were no gaging implements in this country, except Whitworth pins and collars, imported at an expense of $300 to $600 a set, according to the number of sizes embraced, and these gages were found only in a few of the largest shops. Such gages are only for reference, from which other implements are made, hence did not meet the real want of gages that could be given to the men for practical use. Some firms had made forged caliper gages with round or curved contact points, but there was no manufacture of standard gages in this country, nor was there in England, except of pins and collars, down to 1878, as some future explanations will show.

"With this much in respect to the derivation and nature of gaging implements, I will now revert to the history of their manufacture in this country, in so far as I had a part in this matter.

"This is done with some diffidence, and the excuse for introducing a matter so personal in nature must be the great interest I once took in the subject, and a belief that among the few contributions I have been able to make to the advancement of constructive practice, this is by far the most important and the one I especially desire to be known, if any at all, when my work is ended.

"In 1862, when foreman in the works of the Ohio Tool Co., at Columbus, Ohio, I had occasion to make some duplicate work, and not having any means of attaining standard sizes I sent to Jones & Laughlins, at Pittsburg, makers of cold rolled shafting, asking them to send a piece of 2-inch shafting that would fit the Whitworth collars they used in their rolling processes. A selected piece of this shaft about one foot in length, two inches diameter, became a standard, from which was derived a series of sizes from one-half to three inches, in the following manner:

"The cross-feed screw of one of the engine lathes was measured with a rule, and found to be tolerably accurate, the pitch being eight threads per inch. A conical pin of cast iron corresponding to one end of what is called a conical testing standard was put in this lathe and turned in steps by eighths and sixteenths of an inch, but was left a little larger. Then a finely tempered square tool was put in the lathe and its edge set true or parallel to the work. The cross-feed screw was provided with a disk divided into four parts, with a detent that would lock it at these four points. The 2-inch step on the cone was then turned, or scraped until it would caliper the same as the piece of shafting before mentioned. Then the tool was advanced a quarter or half turn and fed over the next step, and so on down to the half-inch size.

"The same process was gone through from the 2-inch step upward to the 3-inch one. This cone was mounted in an inclined position on a cast-iron base and became a standard for sizes, resting, it is true, on a very uncertain standard, but much better than no standard at all.

"It was soon discovered that fixed calipers were required, and I proceeded to make these by cutting out lune-formed pieces from sheets of cast steel, also had some made from forgings of cast steel. A set of these gages, about forty in number, was sent to Messrs Brown & Sharpe, at Providence, R. I., to be ground to size, with flat points, and I believe were the first gages made in this manner. Previously the points had been made curved or convex, offering only line contact to withstand wear. A set of these gages were taken to Messrs. J. A. Fay & Co.'s works, at Cincinnati, O., in 1865, and are no doubt in use there at this time.

"Patents were taken out on the lune-formed, flat point calipers, and on the corrective cone, in 1867, but various circumstances prevented farther work on gages until 1869, when I went to Philadelphia to found if possible the making of my gages and corrective standards.

"Everyone regarded the matter of such gages as a mystery, and set small value on the audacity of a young man from Ohio, who proposed an innovation on the Whitworth system. I learned, as afterwards proved almost true, that the making of gages was in some respects a mystery, and that no one knew how the processes were carried out, but the main impediment was that I proposed a new system.

"I went into various shops to explain how pins and collars were of no use but as a reference, cost too much for common use, and were a foreign product, but no one would aid or join in such an undertaking, and I went on to England, where, at the expense of a good deal of time and money, and from such information as could be gathered, the conclusion was that the means I had at command would be of no use in founding such a business, and the scheme was reluctantly abandoned until 1872. Then having more means I concluded to go on again, and rented one of the front offices in the Franklin Institute building, in Philadelphia, and arranged to have room in the basement to carry on the manufacture of gages.

"In this office were prepared the designs and detail drawings for ten special machines adapted to the various processes required in making calipers and corrective gages. These machines, I mention with some pride. They are all in use today, and, in so far as I know, have not been much modified, although others of various kinds have been added.

"A contract was made with Baxter D. Whitney, of Winchendon, Mass., to construct these machines, which he did with an accuracy that it would be hard to excel at this day. The work occupied about a year, during which time I was in England, and then came the great panic of 1874, which stopped all productive industry in the way of implements of every kind. No one could conceive of what was to come; shops were closed, and skilled mechanics had to beg for their bread.

"My gage-making machines were coated with lead and tallow, boxed up carefully, stored away at Winchendon until August, 1877, when they were sent to Philadelphia, set up, and the gage works, as we supposed, were founded, fifteen years after the first outfit of gages was made at Columbus, O., but the matter had been followed in one way or another all this time, in this country and in England.

"In 1875 or 1876, Prof. John E. Sweet,

at Cornell University, began and carried out there some very complete experiments in making standard calipers that deserve notice and commendation in any history of the art in this country. Some very accurate caliper gages made at the University were exhibited at the Centennial Exhibition of 1876, with much other mechanism designed by Prof. Sweet that attracted wide attention. The first straight-line steam engine, for one thing. The calipers were remarkably good examples, with broad flat points, hard and parallel, but Prof. Sweet, in talking of them, dropped a remark that became significant some years later, as will appear further on. He said: 'We will not make any more of these calipers.'

"I will now quote briefly from a paper of mine read before the Franklin Institute, about 1878, when the various circumstances were better remembered than at this time:

" 'It was thought that in a month or so calipers and corrective gages would be ready for sale, but these expectations were foiled by several circumstances, principal among which was the failure of the measuring machine, fitted with graduating screws made at the Whitworth Company's works in England, and guaranteed as to accuracy.

" 'This matter had before been thought of, but there was scarcely a doubt that the pitch of the screws was correct. Subsequent experiments, however, proved that not only the aggregate pitch was wrong, and the screws not parallel, but the relative pitch in so short a length as seven inches would not do to depend upon. The screws were, no doubt, as the Whitworth Company afterwards maintained, carefully made, but the delicacy of measuring tests demands more accuracy than can be attained by the pitch or movement of screws.

" 'The first experiment in measuring was made by preparing six rods of Stubb's wire, the points nicely finished, and the central part covered with several layers of thick soft paper to prevent induction. These rods were carefully fitted into the machine when set at six inches, temperature and other conditions being carefully observed. The rods were then uncovered and fitted into a groove cut on the side of a bar of pine wood, and taken to Messrs. W. B. Bement & Sons' works, where a Whitworth master screw, with the necessary conveniences for testing the rods, was supplied, and even the experiments conducted by the firm, who were kind enough to take a great interest in the matter. By careful comparison it was found that the measuring machine in comparison with the screw recorded about one in ten thousand short. This, of course, stopped gage-making for the time. The test rods were then taken to London, and in three separate experiments on different standards—two by myself and one by Gen. B. C. Tilghman, member of the Institute—it was found that the rods were short, the variation being but little in the three cases, and corresponding very nearly with the less perfect experiment at Philadelphia.

" 'The next operation was to procure four standard test rods, from Troughton & Sims, of London, adjusted to the imperial yard of Great Britain and its divisions, by which the measuring machine in Philadelphia could be adjusted. Such rods were prepared in London with great care by those having access to the imperial standard, and my son, Mr. George Richards, then in England, brought them out to Philadelphia, and began the correction of the measuring machine, proving by combinations of the rods, comparing with Whitworth gages, and other references, but especially by combination. In the meantime another set of test rods were preparing in Manchester, England, and were forwarded to Philadelphia to prove the first set, and also the machine, which had then been tolerably well adjusted.'

"The adjustment of this standard machine occupied one month's time. The room was kept at one temperature, as nearly as possible, and thousands of readings were taken off, and when finally done, and the screws calibrated, the profile of error was curious to observe; the profile of one screw was convex, so to speak, and the other concave in respect to the axes.

"I will remark here that any screw of reasonably accurate pitch can be made to measure or move for delicate measurements if its errors are translated to the reading scale, that is, if the scale or the index point on the scale, is arranged to vary with the errors of the screw. Suppose, for example, that the pitch of screw varied $\frac{1}{100}$ of an inch for each convolution, either long or short, this would make no difference if the scale from which readings were made was adjusted forward or back $\frac{1}{100}$ of an inch at the same time. This was the method of adjustment adopted for all measuring machines that were made at the Philadelphia works. The errors of the screws were compensated by the indices.

*(To be concluded next week.)*

▲ ▲ ▲

## Burning of a Naphtha Launch.

The large naphtha launch "Thelma," with her owner, J. A. Mollenhauer, and wife aboard, bound for Newport, R. I., took fire early on the morning of July 7th, on Long Island Sound, burning so fiercely that those aboard had barely time to take to the boats. The "Thelma" was 76 feet long and nearly 12 feet beam. She had two screws, with a motor for each of 12 horse power, and two naphtha tanks of 300 gallons capacity each, and was capable of running five or six days on one filling. As to the cause of the explosion and fire, it is stated that the engineer had taken out one of the naphtha injectors to clean it.

## Coloring Patterns.

Noticing a reference to the practice of Oberlin Smith in the matter of coloring patterns, H. M. Lane, of Cincinnati, send us a small blueprint sheet which is used as a posted notice in the pattern shop and foundry of the Lane & Bodley Co. It goes further in this matter of coloring patterns than anyone else goes, so far as we know; but the color-blind man might prefer to have the words "iron," "brass," "steel," etc., marked on the patterns, and this plan would have some other advantages perhaps. The notice is as follows:

Sketch 4648.

NOTICE.

1. Patterns for iron castings to be black.
2. Prints for sand cores to be red.
3. Shape of core on faces of parted pattern to be red.
4. Prints for metal to be cast-in to be blue.
5. Surface of patterns against which a loose piece joins to be yellow.
6. Patterns for brass to be shellac.
7. Patterns for bronze to be green.
8. Patterns for steel to be maroon.
9. Faces which must be clean to be white.

THE LANE & BODLEY CO.

December 27, 1895.

▲ ▲ ▲

## A Water-Tube Boiler Accident.

A disaster with loss of life occurred recently to the ironclad "Janrequiberry," one of the finest and latest additions to the French Navy. The vessel has 24 water-tube boilers of the Lagrafel-D'Allest type. On the twentieth hour of a 24-hour trial trip off Toulon, an explosion occurred in one of the boilers, the rush of steam and flame from the furnace doors severely scalding nine stokers, six of them dying in a few hours. It was found that one of the tubes had drawn from the front plate and burst, while several other tubes were drawn or bent.

▲ ▲ ▲

## The Tree of Knowledge.

A trial was recently made in Austria to decide in how short a space of time living trees could be converted into newspapers. At Elsenthal, on April 17th, at 7:35 in the morning, three trees were sawn down; at 9:34 the wood, having been stripped of bark, cut up, and converted into pulp, became paper, and passed from the factory to the press, from whence the first printed and folded copy was issued at ten o'clock. So that in 145 minutes the tree had become newspapers.

▲ ▲ ▲

## "Journalism."

A daily paper, in speaking of some of its contemporaries' "wild and woozzy" methods of handling the recent political conventions, says:

"One great journal is said to have its 'convention staff' seated in a show window

near the hall, each 'star writer' having his name displayed in large letters on the front of his desk, composing his 'piece' for his paper in the full gaze of the admiring populace. Could there be a more inspiring spectacle than this—a great journalist thinking in public with everybody free to witness the wonderful operation? This is really an improvement upon the method sometimes employed of publishing the writer's picture at the head of his 'piece,' for there might be a 'fake' about that—he might get somebody else to write it for him. Under the latest plan the intellectual process called thought goes on in the open, and the effect upon the youth of the land cannot fail to be inspiriting."

▲ ▲ ▲

The aid given by the Pelton water wheel to the development of electrical industries is by no means small. The remarkable flexibility of this wheel, by which almost any speed can be had, regardless of the head under which it works, or the power developed, is the fundamental reason of its usefulness. In consequence of this, it is possible in a great many cases to make the speed of the wheel the same as that of the dynamo, and hence mount it on the same shaft. This construction is the one adopted at the Fresno, Cal., transmission, the wheels being there placed under the enormous head of 1,400 feet. The "Engineer," of London, recently gave the Pelton wheel as one of several modern inventions which could not have been originated by a scientifically educated engineer. It operates on a principle which until recently was considered incompatible with high efficiency, and, according to the "Engineer," required a mind free from the bias of theoretical training to recognize its possibilities. Its influence in developing the industries of the Pacific Coast is almost beyond estimate.

▲ ▲ ▲

One of the most interesting of recently installed electric plants is at Fresno, Cal. The three-phase system is used, the pressure on the line being 11,000 volts, obtained by step-up transformers at the power house, and reduced again to safe and workable pressures at the consuming end. This high pressure is adopted on the transmission line in order to economize in the conductor, which is very long—nearly thirty-five miles. If long-distance electric transmission is to be successful, it seems that high-pressure currents on the main line, with transformers to provide for low pressures at the producing and consuming ends, will be the system adopted.

▲ ▲ ▲

The boiler of the steam launch "Titus Sheard," which exploded on the Erie Canal at Little Falls, N. Y., killing a dozen persons, was built in 1881, and was never repaired or even examined as to its condition. It had been used intermittently and was very badly corroded.

# Help Wanted.

**Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

**TO SUBSCRIBERS**

**whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.**

Wanted—Pos. as brass foundry foreman; good ref. as to ability and char. Box 200, AM. MACH.

Exp. mech. dftsman wants pos.; good references. Ad. Max Brauner, 65 St. Marks Place, B'klyn, N. Y.

Wanted - Pos. as drfst. on dynamos, motors, bicycles, spec. mach., tools. Refs. Box 206, AM. MACH.

Wanted—Pos., good pattern maker, 20 yrs.' exp. A1 refs.; worked at all branches. Box 203, AM. MACH.

Pattern maker wishes situation; age 22; 7 years experience, sober and steady; reference; would go south. Box 204, AMERICAN MACHINIST.

Mech. draftsman and tool maker, Swede, tech. educated, wishes position; 10 years' office and shop experience. Box 208, AMERICAN MACHINIST.

Position as assistant to mechanical engineer, by experienced machinist having had 3 years' technical training. Box 212, AMERICAN MACHINIST.

Position wanted as sup't or gen'l foreman. Practical mechanic, in charge of men and work 10 yrs. Piece work prices and est. Box 207, AM. MACH.

Wanted—Position as millwright or general machinist, 20 years' exp. in factory repairs. A1 references. Address, Box 213, AMERICAN MACHINIST.

Situation wanted by man who knows how to design and build gas engines. Address, Box 209, AMERICAN MACHINIST.

A first-class hydraulic eng. & mach. wants pos.; well up in water w'ks; would pref. near N. Y. but will go anywhere. Box 93, Kansas City, Kansas.

Wanted—Position as foreman or otherwise; experienced in accurate interchangeable work; used to handling men profitably. Box 198, AM. MACH.

Wanted—Situation by blacksmith on medium heft machine forgings; used to power or steam hammer; best of references. Box 194, AM. MACH.

Experienced hand on 2x24 flat turret, and all other make of turret lathes, desires position to take charge or on machines. Ref. Box 205, AM. MACH.

Mechanical engineer, technical graduate, several years' pract. exp., good salesman, desires position. First-class references. Address Box 214, AM. MACH.

Wanted—First-class machine shop foreman, one with experience in wood-working machinery; married man preferred. Studebaker Bros. Mfg. Co., South Bend, Ind.

An all-round blacksmith wants a position; would take tool fire and agree to pay for all tools spoiled in hardening; reference if desired. Address Box 196, AMERICAN MACHINIST.

Wanted—By manufacturers of engines and dynamos, in Pennsylvania, a foreman; only a first-class man need apply. Write, giving references and experience. Box 202, AMERICAN MACHINIST.

Wanted—Position in charge gen. machine shop; much exp. also in constructing & repairs of mach. & appliances for refrig. breweries, packing houses, cold storage houses, etc. Box 210, AMER. MACH.

An energetic foreman open to engagement. Tech. graduate with 14 years' pract. exp. In executive ability, and estimating on cost of machinery. A1. Good references. Box 211, AMERICAN MACHINIST.

Does anybody want a mechanical draftsman; a good, practical man who can work out other people's ideas as well as his own and make things come together right? Address Box 195, AMER. MACH.

Wanted—Position by an electrical engineer, capable of designing high-grade direct current apparatus for light or power and superintending construction of same. Address Box 191, AMER. MACH.

Mech. engr. with 18 years' exp., including tech. college course, shop and office w'k, wants sit.; exp. in heavy gen. machy., water wheels, power installations, transmission machy., structural work; good draftsman; references. Box 190, AMER. MACHINIST.

Machine shop foreman wants to change; can get out work accurately, quickly, and handle men and tools to best advantage; high class specialties, engines or general machine work. Address Box 193, AMERICAN MACHINIST.

# Miscellaneous Wants.

**Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.**

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co.

For sale—Buckeye Eng., pract. new, 11x14, rating 70 to 90 H.P., $450.00. S. M. York, Cleveland, O.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

Launch for sale cheap—20 ft. Shipman oil burning steam launch. J. M. Kingsbury, Little Falls, N. Y.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co. Middletown, Ohio.

Inventors—Patents procured, construction, drawings and inventions perfected by Wm. G. Nelson & Co., mech. engrs. & pat. attys, 108 Fulton st., N.Y.

Cheap for quick sale.—1 Wheeler Planer 42 x 42, very heavy, first-class condition; cost $1,900, will sell for $650. Butterworth & Lowe, Grand Rapids, Mich.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call or get list 17 B. The Garvin Mach. Co., 440 Canal st., N. Y.

**Valuable ...Books.**

**SHOP KINKS.**
By ROBERT GRIMSHAW.
400 pp., 222 illustrations.
Price, $2.50.

**THE MODERN MACHINIST.**
By JOHN T. USHER.
2d edition. 322 pp., 257 illustrations. Price, $2.50.

These books show by plain description, and by profuse engravings made expressly for them, all that is best, most advanced, and of the highest efficiency in modern machine shop practice. They are right up to date, and are written by men who understand the subject.

*** Copies mailed on receipt of price, or special circular sent on request.

Send for our catalogue of books for Machinists, Engineers, Electricians, and all practical subjects.

**NORMAN W. HENLEY & CO., Publishers,**
**15 Beekman Street, New York.**

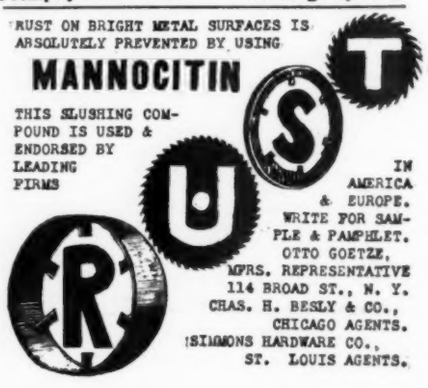
**CURTIS & CURTIS,**
66 GARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery,
FOR HAND OR POWER,
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

**I would like to be the Patent Attorney who comes first to your mind.**
**L. SEWARD BACON,**
Correspondence Promptly Answered.
614 F Street, N. W., Washington, D. C.

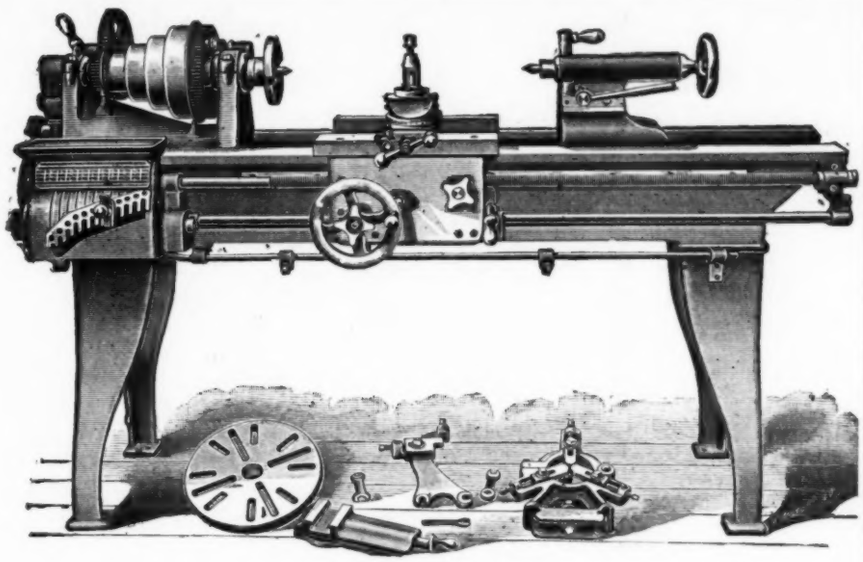
RUST ON BRIGHT METAL SURFACES IS ABSOLUTELY PREVENTED BY USING

**MANNOCITIN**

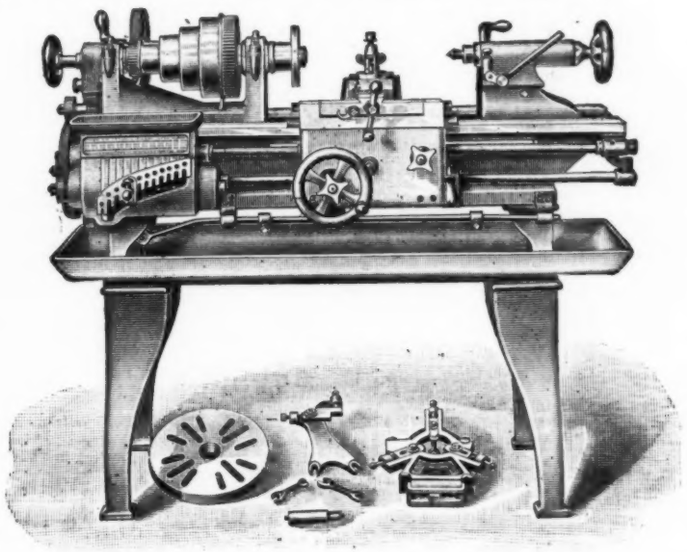
THIS SLUSHING COMPOUND IS USED & ENDORSED BY LEADING FIRMS




IN AMERICA & EUROPE.
WRITE FOR SAMPLE & PAMPHLET.
OTTO GOETZE, MFRS. REPRESENTATIVE
114 BROAD ST., N. Y.
CHAS. H. BESLY & CO., CHICAGO AGENTS.
SIMMONS HARDWARE CO., ST. LOUIS AGENTS.



14-in. x 6 ft. Hendey-Norton Lathe, and 12-in. x 4 ft. Hendey-Norton Lathe. These are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear, and movement of lever in gear box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction. Invaluable for internal or duplicate work.



The 12-in. Lathe is fitted with drawing-in sleeve and American Watch Tool Co.'s Standard Chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterward. No centering required. See carriage reverse lever by right-hand side of apron; no reaching for countershaft shipper required.

SEND FOR CATALOGUE.

# The Hendey Machine Co.,
## TORRINGTON, CONN.

European Agents:

CHAS. CHURCHILL & CO., London, Eng.
SCHUCHARDT & SCHUTTE, Berlin, Germany.
EUGEN SOLLER, Basel, Switzerland.

# Commercial Review.

NEW YORK, SATURDAY EVENING, JULY 11th.

## Dynamos and Motors.

This is the time of year when the hackneyed phrase "midsummer dulness" is sure of infliction upon the public. But the qualification imparted to the term by the adjective destroys, to a great extent, its alarming significance. Naturally, then, we are not surprised to learn from various sources that trade is inclined to go slow; but yet there are some parties whose business is well maintained, and this we understand to mean not merely that their factories are more or less hard at work, but that orders still continue to come in.

It is appropriate at this season to compare the past half year's trade with that of the first six months of previous years; and to avoid an invidious comparison, 1895 will be the best for that purpose. A gentleman speaking for some of the largest electrical interests in the country, states, as his opinion, that in general, the volume of the business this year has not been less than that of last year; that electrical machinery for power, railway and mining purposes, including stationary motors, has sold rather better than a year ago, while generators for incandescent electric lighting not quite as well.

There is some difference of opinion as to the trade in incandescent lighting dynamos. This was a line spoken of during this year in rather favorable terms; the sale of isolated plants formed quite a feature in the general electrical market. But, after all, the sum total does not seem to have been remarkable as compared with other years. It is said that one of the obstacles with which the isolated plant work has to contend is the disposition on the part of some people to take their current from street circuits and bottle it up in storage batteries, for use. A more serious obstacle has been the disposition on the part of most people, not to take currents from anywhere.

Arc lighting work, being out of season, has been relatively unheard from during the six months just closed.

Quite an amount of business was received from street railways, for which line of trade the season is said to have been rather late in opening. But it was chiefly for purposes of repair or extension. Although there were many inquiries, and new enterprises were projected, great hesitation was shown in forwarding them to the extent of giving out actual orders for machinery. Let us hope that enough of these are now in abeyance, pending a satisfactory settlement of public questions, to impart to business an immediate stimulus when that blessed time arrives. Street railway projectors are also waiting to see the result of the compressed air, and the underground current systems; the former of which is to be exemplified in this city

and in Washington, D. C.; the latter in Wilmington, Del.

Motors for power purposes, such as the electrical distribution of power through shops, have constituted a prominent feature of the year's trade. Fan motors have of late been on the carpet, but the period of greatest activity for them is said to have passed. The general inference to be drawn from some dissimilar experiences in this branch of business, is that this has not been a good year.

The truth of the matter is, that inquiry among leading dynamo and motor interests represented in this city elicits very different opinions concerning the relative trade of the two half years we have been considering. It has been said unhesitatingly that the business of this year shows a falling-off; but, as far at least as its volume is concerned, the weight of authority seems not to sustain this view. The prices at which orders have been taken, however, are extremely low.

Here are reports from an Eastern and from a Western electrical company, regarding the business of the half year. The E. G. Bernard Company, Troy, N. Y., write: "As far as we are concerned, while business generally seems to have been poor, we have sold more machines during the first six months of '96 than we did in the first six months of '95." The Triumph Electric Company, Cincinnati, O., state: "We have found the past six months very much better than those of the year previous, as far as the quantity of business received goes; prices, however, as a general rule, are very much lower."

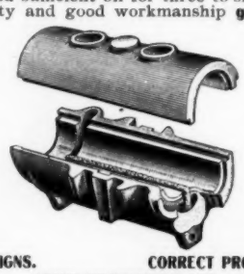
The following communication does not pertain to electrical matters, but shows how such an old and well-known concern as the Buckeye Engine Company, of Salem, O., views business in the steam engine line: "We have looked over our order book back to 1893, and find that May and June of that year brought us orders for two more engines than the corresponding months this year. You know the '93 panic had not yet 'struck' us and we were not then complaining either of orders or payments. In corresponding months for 1894, orders fell off some 30 per cent.; while in 1895 our customers asked us to build 30 per cent. more than in '93 or '96. So much for comparisons. We think people are buying more carefully from year to year, are demanding better machinery and are looking for substantial economies. The business situation is no more satisfactory in our, than in other lines of manufacturing industry. We are hopeful of the future and expect much from the probable success of the Republican party next fall."

### Iron and Other Metals.

The circulation of trade in the iron market is denoted by a week pulse. It is true a leading firm dealing in Southern irons report that these are selling quite actively, at the low prices prevailing, but accord-


O SAY DID YOU SEE THE SMOOTHBORE HANGERS?

**They are reamed on a special machine** which leaves the bearing exceedingly smooth and very accurate. They hold sufficient oil for three to six months. Durability and good workmanship **guaranteed.**



NEAT DESIGNS. CORRECT PROPORTIONS. ACCURATE WORKMANSHIP.

P. PRYIBIL,
512 to 524 West 41st Street,
NEW YORK.
Cable "Pryibil, Newyork." Use A. B. C. Code.

"Knowin' why
is a heap o' satisfaction,"
and it also helps amazingly in thoroughly understanding any subject.

THIS IS WHERE
Machine Shop Arithmetic
DIFFERS FROM OTHER BOOKS.

Its 18 Chapters are full of just the Shop Calculations you need, and it tells the HOW and WHY of each one in plain shop language.

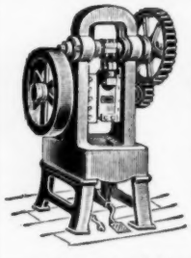
*Screw Cutting, Use of Formulas, Speed of Milling Cutters, Drills, Taps, etc., are among the subjects treated.*

Well bound, handy for pocket, 50 cts.

Practical Publishing Co.
EAST ORANGE, N. J.
2c. U. S. STAMPS TAKEN.

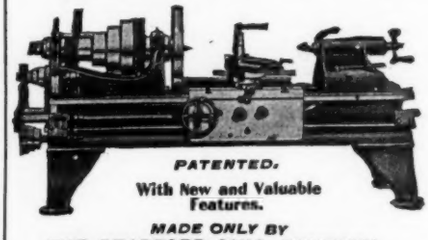
R. Mushet's
SPECIAL AND TITANIC STEELS.
THE STANDARD OF EXCELLENCE.
B. M. JONES & CO.
BOSTON and NEW YORK.

The Toledo Machine and Tool Co.



MANUFACTURERS OF
Power Punching, Drop, Trimming, Stamping, Riveting, Embossing Presses,
With Automatic Feeds.
MACHINES FOR WORKING BAR AND SHEET METALS.
Complete Outfits for Can Making.
SEND FOR CATALOGUE A.
The Toledo Machine and Tool Co.
OAK AND JACKSON AVE., TOLEDO, O., U.S.A.

HIGH CLASS ENGINE LATHES.



PATENTED.
With New and Valuable Features.
MADE ONLY BY
THE BRADFORD MILL COMPANY,
Catalogue "A" describes our Lathes, sent on application. CINCINNATI, OHIO, U. S. A.
LONDON—Chas. Churchill & Co., Ltd., 21 Cross st., Finsbury.
NEW YORK—Garvin Machine Co., Spring and Varick Sts.

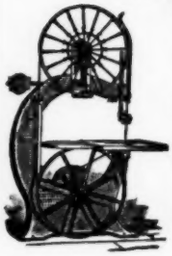
THE TAYLOR-RICE ENGINEERING CO.,
Works: GLOUCESTER CITY, N. J., U. S. A.

ADJUSTABLE BLADE REAMERS
1⅛ in. to 2½ in.
SEND FOR NEW PAMPHLET.

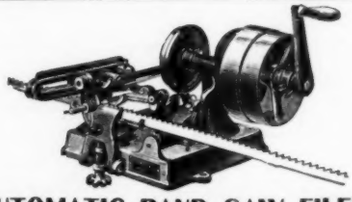
LeCOUNT'S
HEAVY STEEL CLAMP

MANUFACTURED BY
WM. G. LeCOUNT,
SUCCESSOR TO C. W. LE COUNT,
South Norwalk, Conn.
Send for "Catalog A," full line of machine tools

WOOD WORKING MACHINERY
OF EVERY DESCRIPTION.



CAR SHOP TOOLS
—AND—
PATTERN MAKERS MACHINERY,
LEADING SPECIALTIES.
Illustrative and Descriptive matter, with prices on application.
J. A. FAY & CO.,
293 to 313 W. Front St.,
Cincinnati, Ohio.



AUTOMATIC BAND SAW FILER.
REAL PROGRESS. Greatest Labor-Saving Machine in this line. . .
IT PAYS because it increases and improves production and saves saws. A boy can run it. IT PAYS Full particulars in our ad., Vol. 19, No. 27.
P. PRYIBIL,
512-524 West 41st Street, NEW YORK.
Cable "Pryibil, Newyork." Use A. B. C. Code.

# Pratt & Whitney Co. HARTFORD, CONN., U.S.A.

MAKERS OF

## Fine Machine Tools.

**Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.**

ENGLAND—BUCK & HICKMAN, 280 Whitechapel road, London, E.; CHAS. CHURCHILL & CO., LTD., 21 Cross st., Finsbury, London, E. C.
FRANCE—FENWICK FRERES & CO., 21 Rue Martel, Paris; F. G. KREUTZBERGER, 140 Rue de Neuilly Puteaux (Seine).
CHICAGO—42 and 44 S. Clinton st. BOSTON—281 Franklin st. NEW YORK—123 Liberty st

**Superior Quality of Tapper Taps.**
**ADJUSTABLE PLATE AND MACHINE DIES.**
"Lightning" and "Green River" Screw Plates, Tap Wrenches, Reamers, Bolt Cutters, Drilling Machines, etc. **Send for Catalogue.**

**WILEY & RUSSELL MFG. CO., Greenfield, Mass., U. S. A.**

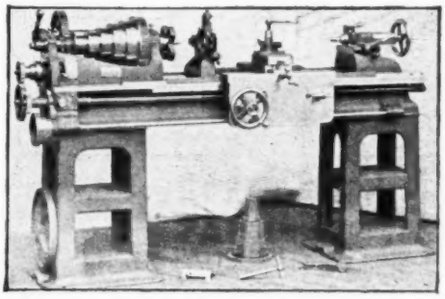
27 YEARS' EXPERIENCE FOR $2.00.

## METCALF'S STEEL.

12MO, CLOTH, $2.00.

Can You Afford to Do Without It?

JOHN WILEY & SONS,
53 East Tenth Street, NEW YORK CITY.

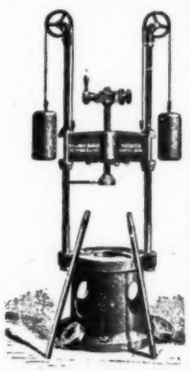


## 14-inch Lathe.

▲▲▲

FITCHBURG MACHINE WORKS

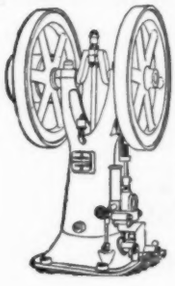
Fitchburg, Mass.



BARNES
**Adjustable Screw Press.**

The most practical tool that could be used in a well equipped up-to-date machine shop. Write for particulars.

**W. F. & JOHN BARNES COMPANY,**
1995 Ruby Street,
Rockford, Ill.



**This beats Wind, Steam or Horse Power.**
We offer the
**WEBSTER** 2 1-2 ACTUAL HORSEPOWER
**GAS ENGINE**

For $150, less 10 per cent. discount for cash. Built on the interchangeable plan. Built of the best material. Made in lots of 100, therefore, we can make the price. Boxed for shipment, weight 800 pounds. Made for Gas or Gasoline.

*Write for Special Catalog.*

**WEBSTER MFG. CO.**
1079 W. 15th St., CHICAGO.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

**J. M. ALLEN, President.**
**WM. B. FRANKLIN, Vice-President.**
**F. B. ALLEN, Second Vice-President.**
**J. B. PIERCE, Secretary and Treasurer.**

**DISCOUNTS** Lowest Cash Discounts allowed on Architectural, Scientific, Electrical, Mechanical, Industrial and Technical Books. Catalogue and Discount Sheet Free. WM. T. COMSTOCK, 23 Warren St., New York.


ing to general opinion things are very quiet. Furnaces are going out of blast leaving stocks of iron already piled up.

In the London copper market, interest has largely subsided, and buying in New York has been conservative. The exports from New York and Baltimore for the week have amounted to about 1,900 tons, making nearly 3,000 since July 1st.

Tin has been quiet in New York, and the speculative prices ruling here have continued relatively lower than those of London.

Some spelter for export is reported to have sold as low as the equivalent of 3.85c., N. Y., but whether it was of a respectable brand is not stated.

## Quotations.

NEW YORK, Monday, July 13th.

Iron—American pig, tidewater delivery:

| | |
|---|---|
| No. 1 foundry, Northern | $12 00 @ $13 25 |
| No. 2 foundry, Northern | 11 50 @ 12 50 |
| No. 2 plain, Northern | 11 00 @ 11 50 |
| Gray Forge | 11 00 @ 11 50 |
| No. 1 foundry, Southern | 11 25 @ 12 00 |
| No. 2 foundry, Southern | @ 10 75 |
| No. 3 foundry, Southern | 10 50 @ 10 75 |
| No. 1 soft, Southern | @ 10 75 |
| No. 2 soft, Southern | @ 10 75 |
| Foundry forge, Southern | 10 25 @ 10 50 |

Bar Iron—Base, in Carloads—Mill price, on dock: common, 1.10 @ 1.20c.; refined, 1.20 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.70c.

Tool Steel—Ordinary sizes, standard quality, 5¾ @ 7c.; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—From store, about 1.75. Special brands upward.

Cold Rolled Steel Shafting—Base size in carloads, about 2⅛c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11⅛ @ 11⅝c.; electrolytic, 11¼ @ 11⅝c.; casting copper, 10¾ @ 11c.

Pig Tin—For 5 and 10-ton lots, 13.55 @ 13.60c. f. o. b.

Pig Lead—In carloads, 2.97½ @ 3.00c.

Spelter—In carload lots, New York delivery 4.00 @ 4.10c.

Antimony—Cookson's, 7.30 @ 7.35; Hallett's, 6.55 @ 6.65c.; Japanese, 6½c.

Lard Oil—Prime city, 40 @ 42c., the higher figure asked for ice pressed.

▲ ▲ ▲

## Index to Advertisers.

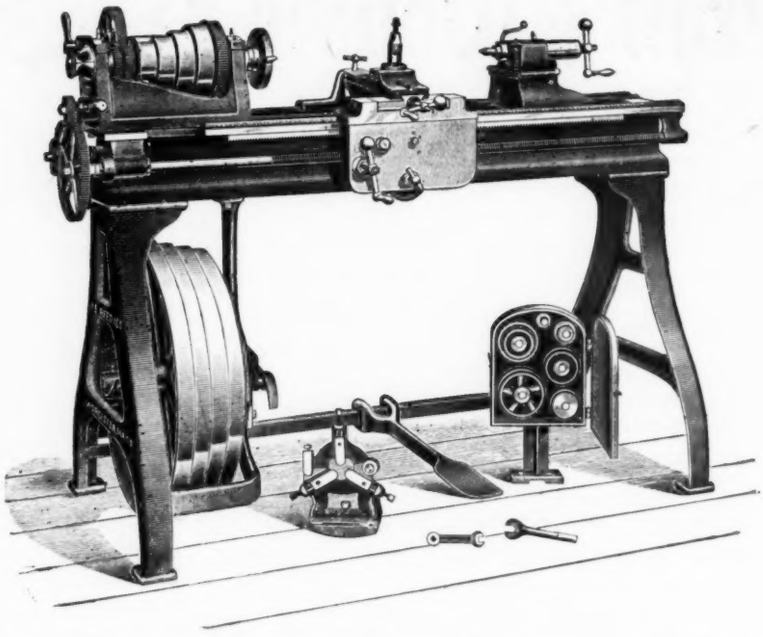

| | PAGE |
|---|---|
| Abbott, Wheelock & Co. | 37 |
| Acme Machinery Co. | Cover |
| Adt & Son, John | 25 |
| Akron Belting Co., The | 26 |
| Albro-Clem Elevator Co. | 38 |
| Almond, T. R. | 34 |
| American Gas Furnace Co. | 33 |
| American Injector Co | 26 |
| Ames Iron Works | 40 |
| Arcade File Works | 32 |
| Armstrong Bros. Tool Co. | 39 |
| Armstrong Mfg. Co., The | 34 |
| Ashcroft Mfg. Co | Cover |
| Aurora Tool Works | 38 |
| Backus Water Motor Co. | 40 |
| Bacon, L. Seward | 20 |
| Baird & Co., Henry Carey | 30 |
| Ball-Bearing Co., The | 27 |
| Barker & Co., William | 30 |
| Barnes Co., W. F. & John | 23 |
| Bates, Henry H. | 30 |
| Baush & Harris Machine Tool Co. | Cover |
| Besly & Co., Chas. H | 35 |
| Bethlehem Foundry and Machine Co. | 26 |
| Betts Machine Co. | 26 |
| Bickford Drill and Tool Co. | Cover |
| Bignall & Keeler Mfg. Co. | 25 |
| Bilgram, Hugo | 35 |
| Blaisdell & Co., P. | 37 |
| Bliss Co., E. W. | 30 |
| Boston Gear Works | 37 |
| Bradford Mill Co., The | 22 |
| Bremer Machine Co., Godfrey J. | 34 |
| Brown & Sharpe Mfg. Co. | Cover |
| Buffalo Forge Co. | Cover |


*(Continued on page 24.)*

**INDEX TO ADVERTISERS—Continued.**


| | PAGE |
|---|---|
| Builders Iron Foundry | 34 |
| Bullard Machine Tool Co. | 32 |
| Burr & Houston Co. | 37 |
| Cincinnati Milling Machine Co. | Cover |
| Cleveland Machine Screw Co | 38 |
| Cleveland Twist Drill Co | 31 |
| Coburn Trolley Track Mfg. Co., The | 26 |
| Coffin & Leighton | 38 |
| Comstock, Wm. T. | 23 |
| Conover Mfg. Co. | 30 |
| Cooke & Co. | 29 |
| Crescent Steel Co. | 37 |
| Curtis & Curtis | 20 |
| Cushman Chuck Co. | 35 |
| Dallett & Co., Thos. H. | 24 |
| Davis, W. P | Cover |
| Davis & Egan Mach. Tool Co | 39 |
| Dawson & Goodwin | 34 |
| Deane Steam Pump Co. | Cover |
| Detrick & Harvey Machine Co. | 34 |
| Diamond Machine Co. | 35 |
| Dietz, Schumacher & Boye | 35 |
| Dixon Crucible Co., Joseph | 39 |
| Dwight Slate Machine Co. | 35 |
| Dyer & Driscoll | 24 |
| Elliott Chemical Works | 38 |
| Erlandsen, J. | 30 |
| Evans Friction Cone Co | 32 |
| Fay & Co., J. A. | 22 |
| Ferracute Machine Co. | Cover |
| Fifield Tool Co. | Cover |
| Fish Machine Works, H. C. | 27 |
| Fitchburg Machine Works | 23 |
| Flather Planer Co. | 25 |
| Foote, Barker & Co | 32 |
| Forbes & Co., W. D. | 34 |
| Fox Machine Co. | 35 |
| Frick Co., The | 40 |
| Garvin Machine Co., The | 28 and Cover |
| General Electric Co. | 27 |
| Goetze, Otto | 20 |
| Goodyear, S. W. | 38 |
| Gould & Eberhardt | 34 |
| Grant Gear Works | 26 |
| Gray Co., G. A. | Cover |
| Harrington, Son & Co., E. | 34 |
| Harrington & King Perforating Co. | Cover |
| Hartford Steam Boiler Insp. and Ins. Co. | 23 |
| Hendey Machine Co | 21 and Cover |
| Henley & Co., N. W. | 20 |
| Hill, Clarke & Co. | 29 |
| Hoggson & Pettis Mfg. Co. | 35 |
| Horton & Son Co., E. | 33 |
| Hurlbut-Rogers Machine Co | Cover |
| Hyatt Roller Bearing Co. | 31 |
| Ingersoll Milling Machine Co. | 38 |
| International Correspondence Schools | 39 |
| Jenkins Bros. | 34 |
| Johnson Co., The | 30 |
| Johns Mfg. Co., H. W. | Cover |
| Jones & Co., B. M. | 22 |
| Jones & Lamson Machine Co. | Cover |
| Kelly & Jones Co., The | 40 |
| Keuffel & Esser Co. | 35 |
| Keystone Engine and Machine Works | 40 |
| King Mfg. Co. | 30 |
| Landis Bros | 30 |
| LeCount, Wm. G | 22 |
| Leland & Faulconer Mfg. Co | 31 |
| Lodge & Shipley Machine Tool Co. | Cover |
| Long & Allstatter Co | 32 |
| Lorain Foundry Co., The | 39 |
| Machinists' Supply Co. | 31 |
| Maris Bros. | Cover |
| McCabe, J. J. | 29 |
| McFadden Co. | 26 |
| Miner & Peck Mfg. Co. | Cover |
| Montgomery & Co | 38 |
| Morse Twist Drill & Machine Co. | 31 |
| Mossberg Mfg. Co. | 27 |
| National Chuck Co. | 35 |
| National Machinery Co. | 27 |
| National Pipe Bending Co. | 37 |
| New Doty Mfg. Co. | Cover |
| New Haven Mfg. Co. | 24 |
| New Process Raw Hide Co | 34 |
| Newton Machine Tool Works | 37 |
| Nicholson File Co. | 26 |
| Niles Tool Works Co. | Cover |
| Niles Tool Works Co., N. Y. Branch | 28 |
| Nolte Brass Co. | 31 |
| Norman Co., J. J. | 40 |
| Norton Emery Wheel Co. | 31 |
| Oneida Mfg. Chuck Co. | 35 |
| Otto Gas Engine Works | 40 |
| Peerless Drilling Compound Co., The | 30 |
| Penberthy Injector Co. | 38 |
| Pierce Engine Co | 40 |
| Place Machine Co., George | 28 |
| Pneumatic Engineering Co. | 31 |
| Practical Publishing Co. | 22 |
| Pratt & Whitney Co. | 23 |
| Pratt Chuck Co. | 35 |
| Prentiss Tool & Supply Co. | 29 |
| Pryibil, P | 22 |
| Purdue University | 32 |
| Quint, A. D | 32 |
| Q. and C. Co | 24 |
| Reed Co., F. E | 24 |
| Replogle Governor Works, The | 29 |
| Roots, P. H. & F. M. | Cover |
| Roth Bros. & Co | 37 |
| Rutnagur & Co., M. C. | 38 |
| Saunders' Sons, D | 25 |
| Sawyer Tool Co. | 25 |


*(Continued on page 25.)*

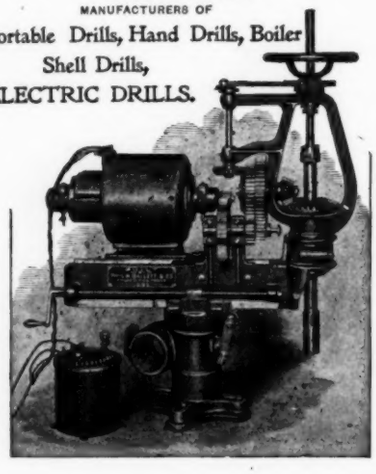
New Pattern 12-inch Screw-Cutting Foot Lathe.

....

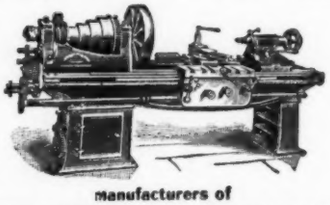
F. E. REED COMPANY,

Gold Street, WORCESTER, MASS.

THOS. H. DALLETT & CO.
PHILADELPHIA.
MANUFACTURERS OF
Portable Drills, Hand Drills, Boiler Shell Drills,
ELECTRIC DRILLS.



NEW HAVEN MFG. CO. NEW HAVEN, CONN.



manufacturers of
IRON WORKING MACHINERY,
Planers, Lathes, Slotters, etc.
CATALOGUE AC.

DYER & DRISCOLL,
PATENT SOLICITORS, 36 WALL ST., N. Y.

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

AUTOMATIC FEED SHOP SAWS
COLD CUT-OFF MACHINES
THE Q AND C CO.
METAL SAWS FOR ALL PURPOSES.
PORTABLE RAIL SAWS
SAVE MONEY
CHICAGO ILL.
SEND FOR CATALOGUE.

# D. SAUNDERS' SONS

21 Atherton St., Yonkers, N.Y.

▲▲▲

Makers of Pipe-Cutting, Threading and Tapping Machines.

▲▲▲

Pipe Cutter Circular for the asking.

**Patent Wheel Pipe Cutter**

shown above combines simplicity with strength and lightness. Easily adapted to various sizes of pipe, rolling instead of sliding motion, no loose parts to become detached and mislaid. All wearing surfaces are of tool steel, hardened. Less friction of parts than any other pipe cutter made.

Established 1866.

# John Adt & Son,

F. B. Shuster, Prop.

700 to 720 State Street, New Haven, Conn., U. S. A.

. Leading Builders of Automatic Wire Straightening and Cutting Machinery, Automatic Sheet Metal Straightening and Cutting Machinery for straightening and cutting wire and sheet metal to accurate lengths direct from the coil. . . . . .

. Machinery and Tools for the manufacture of Hardware, Bicycle, Sheet Metal, Saddlery and Wire Goods. . Special Automatic Wire and Sheet Metal Forming Machinery. . Blanking, Drawing and Combination Dies. Sub-press Drop and Forming Dies and Tools. . . . . .

Send for Red Catalogue 66.

**SEND FOR CATALOGUE.**

**WORCESTER MACHINE SCREW CO**

**Manufacturers of Set, Cap & Machine Screws, Studs, etc.**

# New 20-in.

## Combination Drill,

A most valuable machine for general use. Ask for Drill Book C.

Sibley & Ware, S. Bend, Ind.

**LATHES,**

FOOT POWER MACHINERY OF ALL KINDS,

Bicycle Repair Shop Tools, Vises, Forges, Screw Plates, Taps and Dies, Brazers, Wheel Truers, etc. Scroll Saws and Fancy Woods. Send 4c for Illustra'd Catalog.

THE WILKINSON CO., 83 Randolph Street, Chicago.

Automatic Solid Die Bolt.

**THREADING MACHINES.**

Two Styles. Four Sizes.

Send for Catalogue "A."

WEBSTER & PERKS TOOL CO.

Cor. Spring and Monroe Sts., Springfield, Ohio.

# We Want More

Machinery to build; any kind, terms interesting. Write

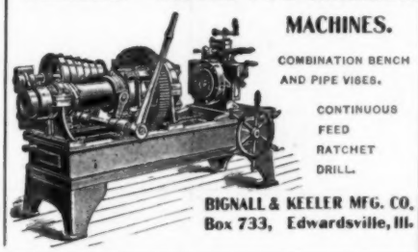
The J. P. Wetherill Machine Co., Chester, Pa.

# Spring Tempered Rules.

One each 1, 2, 3, 4, 6, 9 and 12." 4" Narrow and one center gauge. Sent postpaid until Sept. 1st on receipt of $4.

SAWYER TOOL CO., Athol, Mass.

**"PEERLESS" DUPLEX PIPE THREADING MACHINES.**



COMBINATION BENCH AND PIPE VISES.

CONTINUOUS FEED RATCHET DRILL.

BIGNALL & KEELER MFG. CO. Box 733, Edwardsville, Ill.

18" Crank Shaper.

SEND FOR CATALOGUE

# SHAPERS.

NEW FEATURES.

FLATHER PLANER COMPANY,

NASHUA, N. H., U. S. A.


**INDEX TO ADVERTISERS—Continued.**


| | PAGE |
|---|---|
| Sebastian Lathe Co. | 26 |
| Sebastian-May Co. | 30 |
| Sellers & Co., Inc., Wm. | Cover |
| Seneca Falls Mfg. Co. | 30 |
| Shriver & Co., T. | 32 |
| Sibley & Ware | 25 |
| Skinner Chuck Co. | 35 |
| Slocomb & Co., J. T. | 29 |
| Springfield Gas Engine Co., The | 40 |
| Standard Tool Co. | 37 |
| Stark, John | 37 |
| Starrett, L. S. | 37 |
| Stiles & Fladd Press Co., The | 30 |
| Sterling Emery Wheel Mfg. Co. | 32 |
| Stirling Co., The | 39 |
| Stover Novelty Works | 38 |
| Strelinger & Co., Chas. A. | 29 |
| Sturtevant Co., B. F. | 37 |
| Taunton Locomotive Mfg. Co. | 37 |
| Taylor-Rice Engineering Co. | 22 |
| Timolat, J. G. | 40 |
| Toledo Machine & Tool Co. | 22 |
| Toomey, Frank | 28 |
| Transue & Williams | 34 |
| Trenton Iron Co., The | 39 |
| Trump Bros. Machine Co. | 35 |
| Tuerk Hydraulic Power Co. | 30 |
| Warner & Swasey | Cover |
| Waterbury-Farrel F'dry & Mach. Co. | Cover |
| Waterbury Machine Co., The | 31 |
| Watson-Stillman Co., The | 28 |
| Webster Mfg. Co | 23 |
| Webster & Perks Tool Co. | 25 |
| Wedderburn & Co., John | Cover |
| Wells Bros. & Co. | Cover |
| Weston Engine Co. | 40 |
| Wetherill Machine Co., The James P. | 25 |
| Whiton Machine Co., D. E. | 35 |
| Wiley & Sons, John | 23 |
| Wiley & Russell Mfg. Co. | 23 |
| Wilkinson Co., The | 25 |
| Wilkinson & Co., A. J. | 32 |
| Wilson, W. A. | 29 |
| Wolverine Motor Works | 40 |
| Worcester Machine Screw Co. | 25 |
| Wyke & Co., J. | 30 |
| Wyman & Gordon | Cover |


▲ ▲ ▲

# Buyers' Finding List.

**Adding Machines.**
Grant Calculating Machine Co., Lexington, Mass.

**Air Compressors.**
Rand Drill Co., New York.

**Asbestos Cement Felting.**
Johns Mfg. Co., H. W., New York.

**Balls, Steel.**
Cleveland Machine Screw Co., Cleveland, O.

**Bearings, Anti-Friction.**
Ball Bearing Co., The, Boston, Mass.
Hyatt Roller Bearing Co., Newark, N. J.
Mossberg Mfg. Co., Attleboro, Mass.

**Belting.**
Akron Belting Co., The, Akron, O.

**Belt Dressing.**
Dixon Crucible Co., Joseph, Jersey City, N. J.

**Bicycle Tools.**
Bliss Co., E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Mach. Screw Co., Cleveland, O.
Davis & Egan Mach. Tool Co., Cincinnati, O.
Ferracute Machine Co., Bridgeton, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Wilkinson Co., The, Chicago, Ill.

**Blowers.**
American Gas Furnace Co., New York.
Buffalo Forge Co., Buffalo, N. Y.
Cooke & Co., New York.
Roots, P. H. & F. M., Connersville, Ind.
Sturtevant Co., B. F., Boston, Mass.

**Boilers, Steam.**
Sterling Co., The, Chicago, Ill.
Weston Engine Co., Painted Post, N. Y.

**Bolt Cutters.**
Acme Machinery Co., Cleveland, O.
Davis & Egan Machine Tool Co., Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.
Webster & Perks Tool Co., Springfield, O.
Wells Bros. & Co., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

(Continued on page 26.)

BUYERS' FINDING LIST—Continued.

**Books.**
Audel & Co., Theo., New York.
Baird & Co., Henry Carey, Philadelphia, Pa.
Comstock, Wm. T., New York.
Grant, Geo. B., Lexington, Mass.
Henley & Co., Norman W., New York.
Practical Publishing Co., East Orange, N. J.
Strelinger & Co., Chas. A., Detroit, Mich.
Wiley & Sons, John, New York.

**Boring and Turning Mills.**
Betts Machine Co., Wilmington, Del.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis & Egan Machine Tool Co, Cincinnati, O.
Niles Tool Works Co., Hamilton, O.
Sellers & Co., Inc., William, Philadelphia, Pa.

**Brass Work, Special.**
Nolte Brass Co., Springfield, O.

**Bushings.**
New Process Raw Hide Co., Syracuse, N. Y.

**Calipers.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Standard Tool Co., Athol, Mass.
Starrett, L. S., Athol, Mass.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson & Co., A. J., Boston, Mass.

**Calorimeters.**
Schaffer & Budenberg, Brooklyn, N. Y.

**Castings, Brass.**
Lorain Foundry Co., The, Lorain, Ohio.
Nolte Brass Co., Springfield, O.

**Castings, Iron.**
Builders Iron Foundry, Providence, R. I.
Burr & Houston Co., Brooklyn, N. Y.
Leland & Faulconer Mfg. Co, Detroit, Mich.
Lorain Foundry Co., The, Lorain, Ohio.
Shriver & Co., T., New York.

**Castings, Phosphor Bronze.**
Nolte Brass Co., Springfield, O.

**Castings, Steel.**
Johnson Co., The, Johnstown, Pa.

**Cements, Etc.—Fire-proof.**
Johns Mfg. Co., H. W., New York.

**Centering Drill.**
Slocomb & Co., J. T., Providence, R. I.

**Chucks, Drill.**
Almond, T. R., Brooklyn, N. Y.
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Trump Bros. Machine Co., Wilmington, Del.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Whiton Machine Co., D. E., New London, Conn.

**Chucks, Lathe.**
Cushman Chuck Co., Hartford, Conn.
Dawson & Goodwin, Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
National Chuck Co., New York.
Oneida Mfg. Chuck Co., Oneida, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Pratt Chuck Co., Clayville, N. Y.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.

**Chucks, Tapping.**
National Chuck Co., New York.

**Clutches, Friction.**
Bliss Co., E. W., Brooklyn, N. Y.
Evans Friction Cone Co., Boston, Mass.
New Haven Mfg. Co., New Haven, Conn.

**Condensers.**
Conover Mfg. Co, New York.

**Counting Machines.**
Durant, W. N., Milwaukee, Wis.

**Coverings, Non-conducting Pipe & Boiler.**
Johns Mfg Co., H. W., New York.

**Cranes.**
Harrington, Son & Co., E., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Cutting-Off Machines.**
Armstrong Mfg. Co., The, Bridgeport, Conn.
Hill Clarke & Co., Boston, Mass.
Hurlbut-Rogers Mach. Co., So. Sudbury, Mass.

**Dies, Screw Cutting.**
Acme Machinery Co., Cleveland, O.
Besly & Co., Chas. H., Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Jones & Lamson Machine Co., Springfield, Vt.
Montgomery & Co., New York
Pratt & Whitney Co., Hartford, Conn.
Strelinger & Co., Chas. A., Detroit, Mich.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Drawing Instruments, Etc.**
Alteneder & Sons, T., Philadelphia, Pa.
Keuffell & Esser Co., New York.

(Continued on page 27.)


# NICHOLSON FILE CO.

FREE! Book on Files. 450 ILLUSTRATIONS.

MENTION THIS PAPER.

Do Your Files Wear Out Quickly?
IF SO, TRY
NICHOLSON FILES.
THEY WEAR BETTER AND LAST LONGER THAN ANY OTHERS. THEY COST MORE AT FIRST, BUT
SAVE MONEY
IN THE END.

SAMUEL M. NICHOLSON, PRES. AND GEN. MGR.

More sold than of any other Files in the World.

Box 188, PROVIDENCE, R. I., U. S. A.

## SPEAKING OF LATHES!

We are building them in various sizes from 10 inch to 24 inch swing, in various lengths, both engine and speed lathes. Our designs are the latest and most approved, while the workmanship, material and finish are of the highest order. Our catalogue will tell you all about them, as well as of our planers, shapers, drills and other tools and supplies.

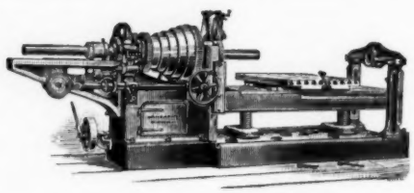
SEBASTIAN LATHE CO.,
117-119 CULVERT ST., CINCINNATI, OHIO.

GRANT GEARS

REMOVAL.

THE GRANT GEAR WORKS, To 6 Portland St., BOSTON.

McFADDEN COMPANY.
TAPS & DIES · VISES · DRILLS · CHUCKS · TWIST · TOOLS · MACHINE · SCREWS · LATHES · FILES · STEEL · TOOL STUBS
No. 722 Arch St., PHILADELPHIA, PA.



## MACHINE TOOLS.

Distinctively Modern
AND Labor-Saving.

BETTS MACHINE CO.
Wilmington, - - Del., U. S. A.

"AKRON" BELTING is guaranteed for the most exacting service. Defective Belts Replaced Free.

THE AKRON BELTING CO.
Manufacturers of Belting and Mill Supplies.
AKRON, OHIO, U. S. A.
Valuable Hand-Book Free.

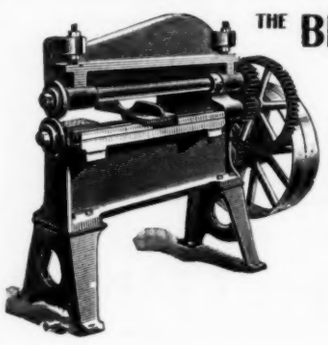
Patent Carrying Track
OVERHEAD TRAMWAY
for Mills, Foundries, Machine Shops, or for Merchandise. *Send for Book.*
The Coburn Trolley Track Mfg. Co.,
... HOLYOKE, MASS ...

## U. S. INJECTORS.

GUARANTEED superior to any other Automatic Injector ever before offered in any market in the world. Works with lower steam pressure than any other; works with higher steam pressure than any other. Handles warmer water than any other. Is more perfectly automatic. No higher price.

WRITE FOR CATALOGUE "I."

AMERICAN INJECTOR COMPANY,
312 West Congress Street, Detroit, Mich.



## THE BETHLEHEM ROTARY SHEAR
Or SLITTER

Will Cut Plates one-quarter inch thick or less from one inch to thirty inches from edge—any length.

It will also CUT SHEET METAL in CURVES or CIRCLES

A Low-priced Machine which pays for itself in a few months.

FURTHER PARTICULARS ON APPLICATION.

BETHLEHEM FOUNDRY & MACHINE CO.
SOUTH BETHLEHEM, PA.

**BOLT and NUT MACHINERY.**

WRITE FOR CATALOGUE & PRICES.

Bolt Cutters, Pointers, Headers, Nut Tappers, Nut Machines, Upsetting and Bending Machinery, Washer Machines, Wire Nail Machinery, Hand and Automatic Spike Machines, Car Link and Pin Machinery.

The NATIONAL MACHINERY CO. TIFFIN, OHIO.

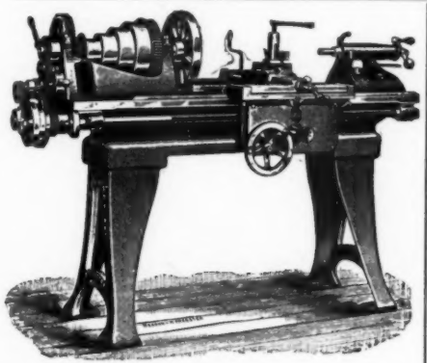
**The General Electric Co.** The largest Factories using Electric Power employ our Apparatus exclusively.

**Motors Dynamos**

For driving Machinery of every description.

Register your name for forthcoming Book on Electrically-Driven Machinery.

GENERAL ELECTRIC CO., 44 Broad Street, New York City.



**Bargains in 14 in. Lathes.**

Circulars on Application.

H. C. Fish Mach. W'ks, Worcester, Mass.

**ROLLER BEARINGS.**

Wonderful results in durability and

POWER SAVED.

Rolling Mill Owners, increase the capacity of your mills by applying

ROLLER BEARINGS.

We are prepared to furnish Bearings for all sizes of Journals. Write for Stock List.

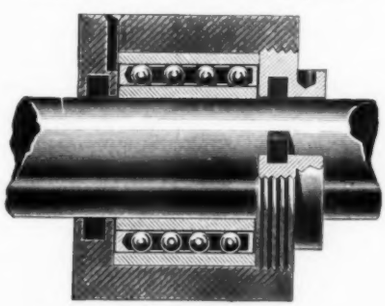
Send six cents stamps for our 1896 Catalogue showing latest improvements in Rolling Mills, Automatic Drop Presses and Power Presses.

MOSSBERG M'F'G CO., ATTLEBORO, MASS.

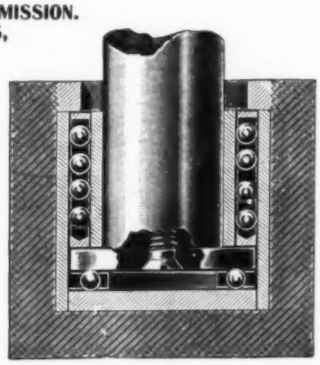
TRADE "HUB" MARK **BALL-BEARINGS**

**For General Machine Construction.**

ENORMOUS SAVING OF FRICTION AND POWER TRANSMISSION.
RADIAL (CYLINDRICAL) AND END-THRUST TYPES,
FOR STANDARD AND SPECIAL SIZES.



Type "A," or Single Radial Bearing. (For Moderate Loads.)



Type D, "Step" or Combination Single Radial and Single End-Thrust Bearing.

**Balls Confined in Cages and Handled as ONE PIECE. No Wear. No Adjustment. No Care. Easily Applied.**
**No Wear on Either Shaft or Box. Balls Have LATERAL TRAVERSE and Roll Only on Hardened Steel, REMOVABLE SURFACES.**

Patented August 29, 1890; April 7, 1891; January 5, 1892; and July 11, 1893.

Caution: Infringement of Patents will be vigorously prosecuted. Descriptive Circular, with full information, Mailed Free on Application.

**THE BALL-BEARING CO.,**

Main Office: WATSON STREET, (NEAR NORTHAMPTON.) ... BOSTON, MASS.

PLEASE MENTION AMERICAN MACHINIST.

**BUYERS' FINDING LIST—Continued.**

**Drilling Compound.**
Peerless Drilling Compound Co., The, Utica, N. Y.

**Drilling Machines.**
Adt & Son, John, New Haven, Conn.
Aurora Tool Works, Aurora, Ind.
Barnes Co., W. F. & John, Rockford, Ill.
Baush & Harris Machine Tool Co., Holyoke, Mass.
Betts Machine Co., Wilmington, Del.
Bickford Drill & Tool Co., Cincinnati, O.
Blaisdell & Co., P., Worcester, Mass.
Dallett & Co., Thos. H., Philadelphia, Pa.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Dietz, Schumacher & Boye, Cincinnati, O.
Dwight Slate Machine Co., Hartford, Conn.
Fitchburg Machine Works, Fitchburg, Mass.
Foote, Barker & Co., Cleveland, O.
Fox Machine Co., Grand Rapids, Mich.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Montgomery & Co., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Quint, A. D., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Sibley & Ware, South Bend, Ind.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.
Timolat, J. G., New York.
Warner & Swasey, Cleveland, O.
Wilkinson & Co., A. J., Boston, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Drill Gage.**
Wyke & Co., J., East Boston, Mass.

**Drill Rods.**
Abbott, Wheelock & Co., Boston, Mass.

**Drills, Twist.**
Besly & Co., Chas. H., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Morse Twist Drill & Machine Co., New Bedford, Mass.

**Drop Forgings.**
Transue & Williams, Alliance, Ohio.
Wyman & Gordon, Worcester, Mass.

**Dynamos.**
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

**Dynamo Brushes.**
Wirt, Charles, Philadelphia, Pa.

**Electric Machinery.**
General Electric Co., New York.

**Elevators.**
Albro-Clem Elevator Co., Philadelphia, Pa.

**Emery Wheels.**
Besly & Co., Chas. H., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Montgomery & Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Sterling Emery Wheel Co., Tiffin, O.
Strelinger & Co., Chas. A., Detroit, Mich.

**Engines, Gas and Gasoline.**
Norman Co., J. J., Chicago, Ill.
Otto Gas Engine Works, Philadelphia, Pa.
Pierce Engine Co., Racine, Wis.
Springfield Gas Engine Co., Springfield, O.
Webster Manufacturing Co., Chicago, Ill.
Wolverine Motor Works, Grand Rapids, Mich.

**Engines, Steam.**
Ames Iron Works, Oswego, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
Forbes & Co., W. D., Hoboken, N. J.
Frick Co., The, Waynesboro, Pa.
Keystone Engine & Mach. Works, Phila., Pa.
Sturtevant Co., B. F., Boston, Mass.
Weston Engine Co., Painted Post, N. Y.
Wetherill Machine Co., James P., Chester, Pa.

**Feed Water Heaters and Purifiers.**
National Pipe Bending Co., New Haven, Conn.
Taunton Locomotive Mfg. Co., Taunton, Mass.

**Files.**
Arcade File Works, New York.
Besly & Co., Chas. H., Chicago, Ill.
Machinists' Supply Co., Chicago, Ill.
McFadden Co., Philadelphia, Pa.
Montgomery & Co., New York.
Nicholson File Co., Providence, R. I.
Strelinger & Co., Chas. A., Detroit, Mich.

**Fire-proof Construction Materials.**
Johns Mfg. Co., H. W., New York.

**Forges.**
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Boston, Mass.
Wilkinson Co., The Chicago, Ill.

*(Continued on page 28)*

**BUYERS' FINDING LIST—Continued.**

**Friction Cones.**
Evans Friction Cone Co., Boston, Mass.

**Furnaces.**
American Gas Furnace Co., New York.
Brown & Sharpe Mfg. Co., Providence, R. I.

**Gages.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Coffin & Leighton, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wyke & Co., J., East Boston, Mass.

**Gauges, Pressure Recording.**
Schaffer & Budenberg, Brooklyn, N. Y.

**Gear Cutters.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Gould & Eberhardt, Newark, N. J.
Grant, Geo. B., Lexington, Mass.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whiton Mach. Co., D. E., New London, Conn.

**Gears.**
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Grant, Geo. B., Lexington, Mass.
New Process Raw Hide Co., Syracuse, N. Y.
Shriver & Co., T., New York.

**Governors.**
Replogle Governor Works, The, Akron, O.

**Graphite.**
Dixon Crucible Co., Joseph, Jersey City, N. J.

**Grinding and Polishing Machines.**
Besly & Co., Chas. H., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Diamond Machine Co., Providence, R. I.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Landis Bros., Waynesboro, Pa.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Norton Emery Wheel Co., Worcester, Mass.
Place Machine Co., George, New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Strelinger & Co., Chas. A., Detroit, Mich.

**Grinders, Center.**
Barker & Co., William, Cincinnati, O.
Leland & Faulconer Mfg. Co., Detroit, Mich.
Trump Bros. Machine Co., Wilmington, Del.

**Grinding Machine, Cock.**
Foote, Barker & Co., Cleveland, O.

**Grinding Machine, Cutter.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Foote, Barker & Co., Cleveland, O.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

**Grinding Machines, Universal.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Landis Bros., Waynesboro, Pa.

**Hack Saws.**
Besly & Co., Chas. H., Chicago, Ill.
Montgomery & Co., New York.
Q. & C. Co., Chicago, Ill.
Stover Novelty Works, Freeport, Ill.
Strelinger & Co., Chas. A., Detroit, Mich.

**Hammers, Drop.**
Bliss Co., E. W., Brooklyn, N. Y.
Long & Allstatter Co., Hamilton, O.
Miner & Peck Mfg. Co., New Haven, Conn.
Mossberg Mfg. Co., Attleboro, Mass.
Stiles & Fladd Press Co., Watertown, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

**Hammers, Power.**
Bremer Machine Co., G. J., Kalamazoo, Mich.
Hill, Clarke & Co., Boston, Mass.

**Hoists.**
Harrington, Son & Co., E., Philadelphia, Pa.
Maris Bros., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Hydraulic Machinery.**
The Watson-Stillman Co., New York.

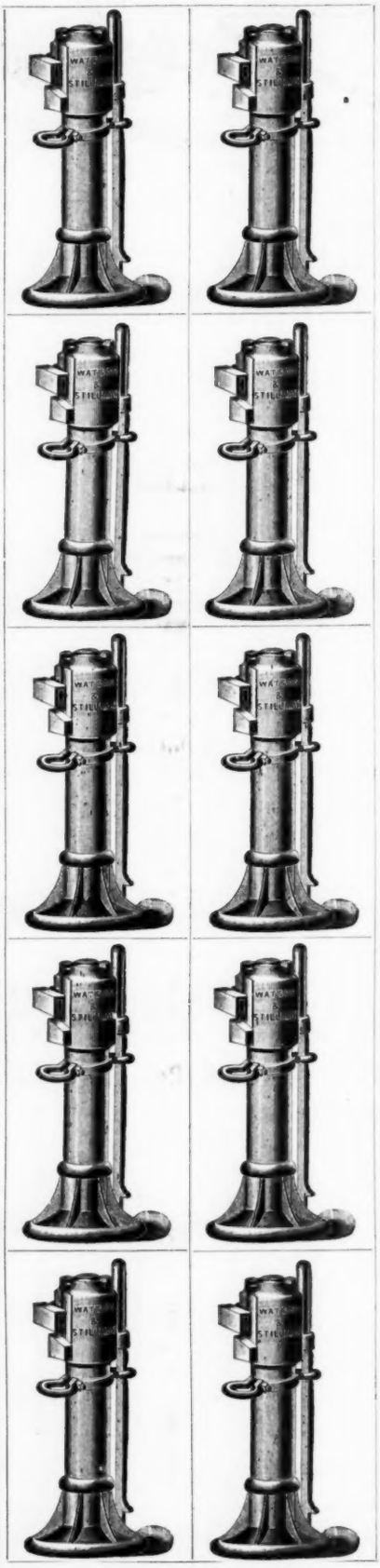
**Indicators.**
Ashcroft Mfg. Co., New York.

**Injectors.**
American Injector Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Keyway Cutter.**
Baker Bros., Toledo, O.

**Lathes (see also Turret Lathes).**
Barnes Co., W. F. & John, Rockford, Ill.
Blaisdell & Co., P., Worcester, Mass.
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Davis, W. P., Rochester, N. Y.

*Continued on page 29.)*

**THE WATSON-STILLMAN CO.**
"JACK MAKERS TO THE UNIVERSE."
**212 East 43d Street, - New York.**
WRITE FOR CATALOG D.

**Bargains in New and Second-Hand Machinery.**
57 inch x 20 feet Planer.
48 inch x 18 feet Sellers Planer.
36 inch x 26 inch and 24 inch Planer.
44 inch x 18 feet Lathe.
32 inch x 20 feet Pond Lathe.
36 inch Boring Mill.
15 inch Gould Shaper with Rack Cutting Attachment.
Large Stock of Lathes, Drill Presses, Bolt and Pipe Cutters, Steam Hammers and General Machinery; Corliss, Automatic and Slide Valve Engines & Boilers.
**FRANK TOOMEY, 131 North 3d St., Philadelphia, Pa.**

**MACHINERY BARGAINS....**
**BEFORE REMOVAL**
**At Phoenix Iron Works, Trenton, N. J.**
**10 ft.-16 ft. Vertical Boring and Turning Mill.**
29 in. x 13½ ft. Engine Lathe.
36 " 20 " " "
37 " 30 " " "
51 " 18 " " "
19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.
Cranes, Blower.
**Send for FULL LIST and Prices.**
**GEORGE PLACE MACHINE CO.**
120 BROADWAY,
NEW YORK.

**GOOD SECOND-HAND MACHINERY.**

**ENGINE LATHES.**
13 in. x 6 ft., Ames Mfg. Co.
14 in. x 6 ft., Flather & Co.
14 in.. x 6 ft., Prentice Bros.
16 in x 6 ft., Blaisdell.
16 in. x 6 ft., Dexter.
16 in. x 8 ft., Blaisdell.
16 in. x 8 ft., Fitchburg.
18 in. x 10 ft., Blaisdell.
18 in. x 10 ft., Flather.
18 in. x 6 ft., Muller.
21 in. x 8 ft., Lodge & Davis.
29 in. x 16 ft., G. A. Ohl.
33 in. x 16 ft., Ames Mfg. Co.
33 in. x 16 ft., New Haven.
34 in. x 20 ft., Perkins.

**PLANERS.**
6 in. x 16 in. x 3 ft., Pratt & Whitney.
20 in. x 20 in. x 5 ft., Haywards.
22 in. x 22 in. x 5 ft., H. C. Pease.
24 in. x 24 in. x 8 ft., Fitchburg.
26 in. x 26 in. x 6 ft., D.W. Pond.

**SHAPERS.**
6 in., Boynton & Plummer.
10 in., Wood & Light, traverse.
10 in., Juengst, crank.
15 in., F. F. Chase, crank.
15 in., Lodge & Davis, crank.

**DRILL PRESSES.**
10 in., Bench, sensitive.
10 in., Slate, 2 spindle.
No. 3 Garvin, 3-spindle.
3-Spindle Hendey.
No. 2 Pratt & Whitney, 4-spindle.
20 in. Quint Turret Drill.
21 in. Prentice B. G. W. F.
25 in. Pond S. H. W. F.
25 in. Barnes B. G. P. F.
Prentice Bros. Suspension.
9 ft. Holly Radial.

**SCREW MACHINES.**
No 5 Brown & Sharpe.
No. 2 1-2 Pratt & Whitney.
19 in. x 5 ft., Windsor.
16 in. x 5 ft., Warner & Swasey.

**MISCELLANEOUS.**
No. 1 Slate Automatic Gear Cutter
No. 1 1-2 P. & W. Hand Miller.
No. 13 Garvin Miller.
1-Spindle Garvin Profiler.
10 in. Diamond Hand Lathes.
12 in. Garvin Hand Lathes.
12 in. x 6 ft. Reid Hand Lathes.
16 in. Square Arbor Fox Lathe.
41-2 in. P. & W. Cut-off Machine.

Write for complete list No. 17, showing a large stock of machinery in addition to this list.
**THE GARVIN MACHINE CO.,**
Spring and Varick Sts., New York.
Also 81 No. 7th St., Philadelphia, Pa.

**SECOND-HAND MACHINERY.**

***LATHES.***
1 13 in. x 4 ft., Ames Eng. Lathe.
1 16 in. x 6 ft., Dustin Eng. Lathe.
3 18 in. x 6 ft., L. & D. Eng. Lathe.
1 19 in. x 6 ft., Fifield Eng. Lathe.
1 20 in. x 11 ft., L. & M. Eng. Lathe with Shafting tool rest.
2 21 in. x 10 ft., Pratt & Whitney.
1 23 in. x 12 ft., White Eng. Lathe.
1 27 in. x 10 ft., Dustin Eng. Lathe.
1 27 in. x 12 ft., Wood & Light.
1 28 in. x 12 ft., Wood & Light.
1 28 in. x 16 ft., Eng. Lathe.
1 30 in. Lodge & Shipley, gear blank and pulley tur. and bor.
1 36 in. x 12 ft., Geared Eng., heavy
1 32 in. x 13 ft., B. & D. triple Gd. S. C. comp. rest.
1 40 in. x 16 ft., geared plain turn'g.
1 48 in. x 18 ft., Gay & Silver.

***PLANERS.***
1 16 in. x 16 in. x 3 ft., Hand.
2 24 in. x 24 in. x 4 ft., Pond.
2 24 in. x 24 in. x 4 ft., W. & L.
1 24 in. x 24 in. x 7 ft., L. & M.
1 28 in. x 28 in. x 8 ft., G. & S.
1 30 in. x 30 in. x 8 ft., S. & S.
1 32 in. x 32 in. x 10 ft., W. & L.
1 32 in. x 10 ft., Open Side.
1 36 in. x 36 in. x 10 ft., New Haven.
1 36 in. x 36 in. x 18 ft., William Sellers.
1 38 in. x 38 in. x 10 ft., Aldrich.
3 48 in. x 32 in. x 6 ft., Pond, with two heads, new pattern.

***DRILL PRESSES.***
6 Sensitive Bench Drills.
4 Suspension Drills, Pond.
1 10 in. two-spindle Sensitive Drill
1 22 in. back-geared Drill.
1 34 in. back-geared Drill.
1 36 in. Gap Drill, power feed.
1 3-spindle Pratt & Whitney, adj.
2 3-spindle Sensitive, adjble.
1 Quint Turret with tapping attachment, six-spindle.
1 4 ft. arm Radial, Hilles & Jones.

***SHAPERS.***
1 15 in. Crank.
1 12 in. Traveling Head.
1 9 in. William Sellers, trvg. hd.
1 13 in. Bement & Sons, trvg. hd.
1 12 in. Howes & Phillips, heavy.

***BORING MACHINES.***
2 No. 2, Bement & Miles, Hzl.
1 No. 2, Pedrick & Ayer Cyl. Borer.
1 36 in. Stevens Pulley.

***SCREW MACHINES.***
1 No. 2, Pratt & Whitney, plain.
1 No. 2, P. & W. W. F. Oil Pump
1 No. 3, P. & W., f. c. hd. bk. gd. p. f. to turret; side oil pump.
1 18 in. P. & W., Turret Head Chucking Machine, oil pump.

***EMERY GRINDERS.***
1 No. 5, Springfield Water Tool Grinder.
1 No. 2, L. & F. Tool Grinder, twp wheels.
1 No. 6, Diamond, surfacing att.
1 No. 3, Universal Cutter Grinder.
1 No. 1, Diamond Univsl. Grinder.
1 Brainard Cutter Grinder, on col.
1 F. & W. Forming Tool Grinder.

***POWER PRESSES.***
1 No. 95, Bliss Double Pitman.
1 No. 4, C. & M., single action.
1 No. 30, Bliss, single action.

***MISCELLANEOUS.***
1 2-spindle Profiler; Edging Mach.
1 4 in. H. & R. Cutting-off Mach.
10 Bench Vises, various sizes.
1 48 in. Gear Cutter.
1 No. 1, Warner & Swasey Vertical Miller.
1 C. & C. Electric Motor, 50 K. W. Generator.
1 Circular Saw, bench.
Forges, Anvils, Chucks, Drills, Shafting, Pulleys, Reamers and Small Tools.

Send for circular list. Prices on application. Also large stock of new tools.
**EASTERN BRANCH, NILES TOOL WORKS CO.**
136-138 Liberty St., NEW YORK CITY.

## MACHINERY FOR SALE.

1 9 x 9 Greenfield Vertical Engine.
1 Vertical Boiler 36 in. x 7 ft.
1 Clipper Vertical Engine, 5 H. P., combined with 6 H. P. Vertical Boiler.
1 Bolt Cutter, ¼ to 1¼, Open Die.
1 No. 1 Roots Blower.
1 " 8 " "
2 " 6 " "

COOKE & CO.,
165 Washington Street, NEW YORK.

## BARGAINS IN SECOND-HAND HAMMERS.

One 1,350 lb. Merrill Friction Drop with B. & S. Automatic Trip and Patent Lever.
One 1,200 lb. Merrill Friction Drop with B. & S. Automatic Trip and Patent Lever.
One 850 lb. Merrill Friction Drop with Regular Trip.
Three 400 lb. Merrill Friction Drops with B. & S. Automatic Trip and Patent Lever.
One 400 lb. Merrill Friction Drop with Regular Trip.
One 300 lb. Pratt & Whitney Friction Drop with B. & S. Automatic Trip and Patent Lever. [Trip.
One 350 lb. Pratt & Whitney Friction Drop with Reg.
One 300 lb. Pratt & Whitney Friction Drop with B. & S. Automatic Trip and Patent Lever.
One 400 lb. Hope Friction Drop with Regular Trip.
Three 400 Poppet Drops with No. 6 Peck Lifters, 16 in. between uprights, 18 in. between poppets.
Two 300 lb. Poppet Drops with No. 5 Peck Lifter, 13 in. between uprights, 17 in. between poppets.
One 175 lb. Palmer Power Hammer with 7 3-4 in. Stroke.
One 100 lb. Hotchkiss Power Hammer with Air Cylinder for hammer variations.

**ALSO THE FOLLOWING AI SECOND-HAND MACHINERY.**

50 x 28 ft. Fifield latest pattern Triple Geared Lathe with Taper.
42 x 10 ft Fifield Lathe; heavy pattern.
36 in. x 16 ft. Prentiss Standard Lathe; nearly new.
26 in. x 22 ft. Pond Machine Tool Co. Lathe; has chuck.
24 in. x 12 ft. Fifield Lathe, Compound Rest; nearly new.
20 in. x 8 ft. Pratt & Whitney Lathe, Compound Rest; in good order. [itor Lathe.
19 in. x 6 ft. American Tool and Machine Co. Fox Mon-
16 in. x 6 ft. Lodge & Barker Square Arbor Fox Lathe.
Style B Full Universal Bickford Radial Drill.
No. 3 Baush Plain Radial Drill.
36 in. New Haven Upright Drill, back gears, power feed.
25 in. Snyder Back Geared and Power Feed Drill.
70 in. x 60 in. x 30 ft. Pond Planer, 2 heads.
60 in. x 60 in. x 25 ft. Pond Planer, single head.
22 in. x 22 in. x 5 ft. Ingersoll Hub Miller; as good as new.
No. 5 Brainard Plain Milling Machine.
D. W. Pond Index Milling Machine. [and Vises.
Five Lincoln Pattern Milling Machines with Tail Stock
No. 2 Landis Universal Grinder.
No. 1 Diamond Universal Grinder.
No. 1 Brown & Sharpe Surface Grinder.
No. 2 Garvin Cutter Grinder.
9 in. Bement Slotter, all feeds.
12 in. Bement Slotter, all feeds.
42 in. Bement Car Wheel Borer, power lift.
62 in. Pond Boring and Turning Mill, 2 heads.
2 in. Saunders Pipe Machine.
Also the best and largest assortment of new Tools in New York City. *Write for Lists.*

PRENTISS TOOL AND SUPPLY CO.,
115 Liberty Street, NEW YORK.
62 and 64 South Canal St.,
CHICAGO, ILL.

## MODERN TOOLS.

GOOD ORDER. SPECIAL LOW PRICES.

**ENGINE LATHES.**
10 in. x 4 ft., Reed.
11 in. x 5 ft., Prentice.
12 in. x 5 ft., Reed.
14 in. x 6 ft., Reed.
15 in. x 6 ft., Blaisdell.
15 in. x 7 ft., Reed.
16 in. x 6 ft., Pratt & Whitney.
18 in. x 8 ft., New Haven.
19 in. x 10 ft., Pond.
20 in. x 8 ft., Pond.
20 in. x 15 ft., Pond.
20 in. x 8 ft., New Haven.
20 in. x 10 ft., Harrington.
22 in. x 12 ft., Perkins.
23 in. x 12 ft., New Haven.
24 in. x 12 ft., Putnam.
26 in. x 12 ft., Bogert Triple G'd.
26 in. x 16 ft., Lathe & Morse.
28 in. x 12 ft., Bradford.
28 in. x 18 ft., Fifield.
42 in. x 16 ft., Hewes & Phillips.
52 in. x 16 ft., Hewes & Phillips.
72 in. x 20 ft., Union Iron Works.

**DRILLS.**
12 in., Sensitive.
20 in., Prentice, Plain.
20 in., " Auto. Feed.
22 in., Snyder, Complete.
24 in., Ames, "
48 in., Heavy Pattern.
Universal Warrens, 5 ft. Arm.

**PLANERS.**
12 in. Stroke, Crank.
16 in. x 4 ft., Hendey.
20 in. x 4 ft., New Haven.
22 in. x 4 ft., New Haven.
22 in. x 5 ft., Pease.
24 in. x 5 1-2 ft., New Haven.
24 in. x 7 ft., Pratt & Whitney.
26 in. x 8 ft., Draper.
30 in. x 6 ft., Pond.
30 in. x 6 ft., Pease.
32 in. x 8 ft., Pond.
36 in. x 12 ft., Pond.
36 in. x 14 ft., Betts.
48 in. x 16 ft., Putnam.
60 in. x 14 ft., Gray.

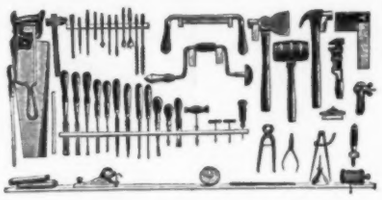
**SHAPERS.**
14 in. Stroke, Gould & Eber.
16 " Prentiss Crank.
16 " Prentiss Friction.
16 " Latest Crank.
22 " Latest Geared.
24 " Hendey Friction.
14 in. Traveling Head, Fitchburg.
14 " " Warren.
14 " " Pratt & Whitney.

**Milling & Screw M'ches.**
Universal Miller.
Lincoln Miller.
Pratt & Whitney Miller No. 2.
No. 2 Screw M'che, Latest.
No. 3 " " P. & W.
No. 4 " " 2 in. Hole.

Horizontal Boring and Drilling Machine, 52 in. Sellers. Upright Boring and Turning Mill, 40 in. Boiler Tools. Punches, Shears and Rolls. Punch Press, Stiles No. 2 and 4. Hammers, Bradley 50 and 200, Hackney 50 lbs.

NEW Bicycle Tools of the most improved construction.

J. J. McCABE,
Successor to E. P. Bullard's
N. Y. Machinery Warerooms.
14 DEY STREET,
NEW YORK.



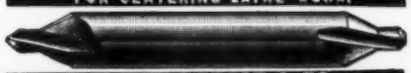
IS THERE ANYTHING BETTER FOR HIM?

Is there anything that your boy—whether he be seven or seventy years old—would like more than a SET OF TOOLS, not toys, but first-class tools ready for use. Wouldn't it be an advantage to have a good Set of Tools in the house?

We manufacture and sell Tools. Our catalogue (sent for stamp) tells all about Sets of Tools, Tool Chests and Work Benches, at all prices.

CHAS. A. STRELINGER & CO.,
98 to 110 Bates Street, Detroit, Mich.

COMBINED DRILL AND COUNTERSINK FOR CENTERING LATHE WORK.

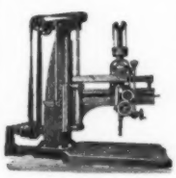


J. T. SLOCOMB & CO.,
PROVIDENCE, R.I. U.S.A.

Gear Cutting Machines,
Milling Machine, and General Line of Machine Shop Tools.
Hill, Clarke & Co.
160 Oliver Street, BOSTON.
16 S. Canal St., Chicago.

Milling Machines.
Nearly 100 different styles and sizes.

Hill, Clarke & Co.
160 Oliver Street, BOSTON.
16 S. Canal St., Chicago.



Radial Drills
and General Line of Machine Shop Tools.
Hill, Clarke & Co.
160 Oliver St., BOSTON.
16 S. Canal St., Chicago.

WILSON IMPROVED IRON PLANERS.
STANDARD SIZES & PATTERNS KEPT IN STOCK.
W. A. WILSON
RIVER ST. ROCHESTER, N.Y.

WATER POWER GOVERNED

for electrical and other work, with results equal to the best Corliss engine practice.
Send for Illustrated Catalogue "A."
THE REPLOGLE GOVERNOR WORKS, Akron, O., U. S. A.
MARK A. REPLOGLE, Chief Engineer.


## BUYERS' FINDING LIST—Continued.

**Lathes—Continued.**
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Dietz, Schumacher & Boye, Cincinnati, O.
Fifield Tool Co., Lowell, Mass.
Fish Machine Works, H. C., Worcester, Mass.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., E., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
New Doty Mfg. Co., Janesville, Wis.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Sebastian Lathe Co., Cincinnati, O.
Sebastian-May Co., Sidney, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stark, John, Boston, Mass.

**Machinists' Tools and Supplies.**
Machinists' Supply Co., Chicago.
Montgomery & Co., New York.
Sawyer Tool Co., Athol, Mass.
Standard Tool Co., Athol, Mass.
Starrett Co., The L. S., Athol, Mass.

**Milling Cutters.**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Erlandsen, J., New York.
Garvin Machine Co., New York.
Ingersoll Milling Machine Co., Rockford, Ill.
Reinecker, J. E., Chemnitz-Gablenz, Germany.
Starrett, L. S., Athol, Mass.

**Milling Machines.**
Bliss Co., E. W., Brooklyn, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Forbes & Co., W. D., Hoboken, N. J.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Ingersoll Milling Machine Co., Rockford, Ill.
Leland & Faulconer Mfg. Co., Detroit, Mich.
McCabe, J. J., New York.
Newton Mach. Tool Works, Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

**Motors, Electric.**
Dallett & Co., Thos. H., Philadelphia, Pa.
General Electric Co., New York.
Roth Bros. & Co., Chicago, Ill.

**Motors, Water.**
Tuerk Hydraulic Power Co., New York.

**Needle Wire.**
Abbott, Wheelock & Co., Boston, Mass.

**Packing.**
Jenkins Bros., New York.
Johns Mfg. Co., H. W., New York.

**Paints, Fire-proof.**
Johns Mfg. Co., H. W., New York.

**Patent Attorneys.**
Bacon, L. Seward, Washington, D. C.
Bates, H. H., Washington, D. C.
Dyer & Driscoll, New York.
Wedderburn & Co., John, Washington, D. C.

**Pattern Letters.**
Montgomery & Co., New York.
Wells, Heber, New York.

**Perforated Metals.**
Harrington & King Perforating Co., The, Chicago, Ill.

**Phosphor Bronze.**
Phosphor Bronze Smelting Co., Ltd., Philadelphia, Pa.

**Pipe, Bent.**
National Pipe Bending Co., New Haven, Conn.

**Pipe Cutting and Threading Machines.**
Armstrong Mfg. Co., The, Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis, Bridgeport, Conn.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Hill, Clarke & Co., Boston, Mass.
National Machinery Co., Tiffin, O.
Saunders' Sons, D., Yonkers, N. Y.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Pipe Fittings.**
Kelly & Jones Co., The, New York.

(*Continued on page 30.*)

**BUYERS' FINDING LIST—Continued.**

**Planers.**
Betts Machine Co., Wilmington, Del.
Davis, W. P., Rochester, N. Y.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Detrick & Harvey Machine Co., Baltimore, Md.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Garvin Machine Co., New York.
Gray Co., G. A., Cincinnati, O.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co, New York.
Ohio Machine Tool Co., The, Kenton, O.
Pratt & Whitney Co, Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Wilson, W. A., Rochester, N. Y.

**Polishing Wheels.**
Builders Iron Foundry, Providence, R. I.

**Presses, Dies, Etc.**
Adt & Son, John, New Haven, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Ferracute Machine Co., Bridgeton, N. J.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Doty Mfg. Co., Janesville, Wis.
Stiles & Fladd Press Co., Watertown, N. Y.
Toledo Machine & Tool Co., The, Toledo, O.

**Pumping Machinery.**
Deane Steam Pump Co., Holyoke, Mass.
Wetherill Machine Co., James P., Chester, Pa.

**Punches and Shears.**
Bliss Co, E. W., Brooklyn, N. Y.
Bremer Machine Co., G. J., Kalamazoo, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Davis & Egan Machine Tool Co., Cincinnati, O.
Long & Allstatter Co., Hamilton, O.
McCabe, J. J., New York.
Mossberg Mfg. Co., Attleboro, Mass.
New Doty Mfg. Co., Janesville, Wis.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
W. & S. Hydraulic Machinery Works, New York.

**Ratchet Drills.**
Bignall & Keeler Mfg. Co., Edwardsville, Ill.

**Raw Hide.**
New Process Raw Hide Co., Syracuse, N. Y.

**Reamers.**
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Taylor-Rice Engineering Co., Gloucester City, N. J.
Wiley & Russell Mfg. Co., Greenfield, Mass.

**Riveting Machine.**
Adt & Son, John, New Haven, Conn.

**Rock Drills.**
Rand Drill Co, New York.

**Rolling Mills.**
Mossberg Mfg. Co., Attleboro, Mass.

**Roofing, Asbestos.**
Johns Mfg. Co., H. W., New York.

**Rules, Graduated Steel.**
Coffin & Leighton, Syracuse, N. Y.
Darling, Brown & Sharpe, Providence, R. I.
Sawyer Tool Co., Athol, Mass.
Standard Tool Co., Athol, Mass.
Starrett Co., L. S., Athol, Mass.
Wyke & Co., J., East Boston, Mass.

**Rust Preventing Compound.**
Goetze, O., New York.

**Saws.**
Q. & C. Co., Chicago, Ill.

**Sawing Machines, Metal.**
Q. & C. Co., Chicago, Ill.

**Schools.**
International Correspondence Schools, Scranton, Pa.
Purdue University, Lafayette, Ind.

**Screw Machines (see Turret Lathes).**

**Screws, Machine.**
Cleveland Machine Screw Co., Cleveland, O.
Flather & Co., Nashua, N. H
McFadden Co., Philadelphia, Pa.
Worcester Machine Screw Co., Worcester, Mass.

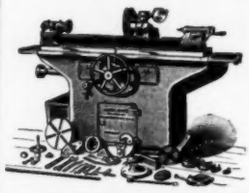
**Screw Plates.**
Machinists' Supply Co., Chicago, Ill.
Wells Bros., Greenfield, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Wilkinson Co., The, Chicago, Ill.

**Screws.**
Cleveland Machine Screw Co., Cleveland, O.
Worcester Machine Screw Co., Worcester, Mass.

**Separators, Steam.**
Keystone Engine and Machine Works, Philadelphia, Pa.

**Shafting, Hangers, Etc.**
Pryibil, P., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

(Continued on page 31.)

Let us give you **A POINTER ABOUT "GRINDING."**

We guarantee to finish more shafts, spindles, etc., with one man, by our method, than can be done on three lathes, and do it better; besides, it is the only way to finish hardened work. It is a fact that some of the users of our machines are making better records than this. Can't we help to increase your profits? Write for "treatise."

**LANDIS BROS., Waynesboro, Pa.**

AGENTS { GERMANY: SCHUCHARDT & SCHUTTE, 59 Spandauerstrasse, Berlin. FRANCE: AD. JANSSENS, 16 Place de la Republique, Paris. ENGLAND: CHAS. CHURCHILL & CO., 21 Cross Street, Finsbury, London. AUSTRIA: SCHUCHARDT & SCHUTTE, 17 Breitgasse, Vienna.

**"A Machine Shop with modern equipment, heavy and light machinery, cranes of 20 tons capacity and 10,000 square feet of unoccupied floor space. Would contract to manufacture any kind of machinery."**
**Address: BOX 62, AMERICAN MACHINIST.**

**STAR LATHES**
★ ★ ★
Foot Power Screw Cutting, Automatic Cross Feed, 9 and 12" Swing.
Send for Catalog B.
**Seneca Falls Mfg. Co.**
687 Water St., Seneca Falls, N.Y.

WYKES IMPROVED END GRADUATED HARDENED MACHINISTS SCALES

SEND FOR DISCRIPTIVE LISTS TO J. WYKE & CO MFRS OF FINE MACHINISTS TOOLS E. BOSTON MASS

**CENTER GRINDERS,**
WILLIAM BARKER & CO., Mfrs.,
**IRON AND BRASS WORKING MACHINERY,**
CINCINNATI, OHIO.

**PATENTS.** HENRY H. BATES, Solicitor,
Counselor in Patent Cases.
Formerly Examiner-in-Chief, Board of Appeals, U. S. Patent Office. Applications prosecuted. Defences indicated. Correspondence invited.
Address, McGILL BUILDING, Washington, D. C.

**TUERK WATER MOTOR**
¼ to 10 horse power, according to size and water service. The best, cheapest, neatest, handiest, SAFEST power. *Always ready.* Thousands in use for machinists, printers, etc. Send for circular and price stating water pressure and use.

**Tuerk Hydraulic Power Co.,**
23 Vandewater St., New York.
39 Dearborn St., Chicago, Ill.

**Lathes** 8 to 18 inch Swing.
SEBASTIAN-MAY CO.,
SIDNEY, OHIO.

**HENRY CAREY BAIRD & CO.,**
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
**810 Walnut St., Philadelphia.**
☞ Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

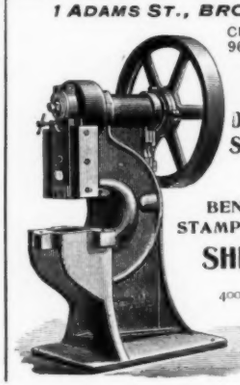
**SALESMEN WANTED** $100 per month and expenses. Address with stamp, King Mfg. Co., H31, Chicago.

**CONOVER'S** IN STOCK HANDSOME CATALOGUE ON **CONDENSERS**
THE CONOVER MFG. CO. 39 CORTLANDT ST. N.Y.

**STEEL CASTINGS** from 10 lbs. upward. Made from best open hearth steel. Also sand rolls and cast-iron pinions.
THE JOHNSON COMPANY, Johnstown, Pa.
*SEND FOR ESTIMATES.*

**One Cent** per gallon will cover the expense of making a perfect substitute for "cutting oil" now being used by leading machinists.
**PEERLESS DRILLING COMPOUND**
is shipped on trial to responsible parties without expense. Ask for "yard" of unsolicited testimonials."
THE PEERLESS DRILLING COMPOUND CO.,
850-52 Genesee St., UTICA, N. Y.

**E. W. BLISS CO.,**
1 ADAMS ST., BROOKLYN, N. Y.
CHICAGO OFFICE, 96 W. WASHINGTON ST.



**PRESSES,**
Drop Hammers and Special Machines
FOR PUNCHING, BENDING, FORMING, STAMPING, BLANKING, etc.
**SHEET METAL.**
400 Page Catalogue.
OWNERS OF THE STILES & PARKER PRESS CO.

Drop Hammers, Presses, Special Mach'y Dies.
THE STILES & FLADD PRESS CO.,
WATERTOWN, N. Y.

## Of Lathe-Center Grinders.

WE unhesitatingly confess to making the very best in existence—one that is exceedingly simple—that will grind the hardest centers in a lathe of any size, up to 30-inch swing; do it quickly and do it well—a Center Grinder that is absolutely self-contained, and dispenses with all of the troublesome "toggery" that usually attends upon the ministrations of such tools. One more point: 'tis of moderate cost. We issue quite an exhaustive treatise anent this little tool. Shall we mail it?

**Leland & Faulconer M'f'g Co.,**
Detroit, Michigan.

**CLEVELAND TWIST DRILL CO.'S GRIP SOCKETS.**

No More Twisted Tangs.

Larger drills can be used with smaller shanks than ever before.

No charge for the groove in the shanks.

Send for Descriptive Price List.

**Cor. Lake and Kirtland Sts., Cleveland, Ohio.**

NORTON EMERY WHEEL CO.

WORCESTER, MASS.

SEND FOR ILLUSTRATED CATALOGUE

**MORSE TWIST DRILL AND MACHINE COMPANY,** NEW BEDFORD, MASS.

**Manufacturers of Morse Patent Straight-Lip Increase Twist Drills.**

SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS.

Drill Grinding Machines, Milling Cutters and Special Tools to Order.

**Locomotive Engineering**

is the most interesting and finest illustrated railroad paper published. Price $2.00 a year. . . .

SINCLAIR & HILL,
256 Broadway, New York.

Specimen copy free.

**The Halsey Pneumatic Pump.**

For pumping water by direct air pressure.

SIMPLE, AUTOMATIC, PERFECT.

*Send for Pamphlet A.*

PNEUMATIC ENGINEERING COMPANY,
100 Broadway, NEW YORK.

**FLEXIBLE ROLLERS IN STEEL BOXES.**

"The wonder is, that this simple yet perfect Bearing was undeveloped and hidden so long."

HYATT ROLLER BEARING CO.,
General Office, 450 Market St., NEWARK, N. J.
NEW YORK OFFICE: 26 Cortlandt Street.

**BRASS CASTINGS** for all purposes. PHOSPHOR BRONZE for Machine Box Bearings, etc. Special Finished Brass Work to order.

*NOLTE BRASS CO.*
68 AND 70 EAST WASHINGTON STREET, SPRINGFIELD O.

**WIRE** THE WATERBURY MACHINE CO.,
Waterbury, Conn.,
Owners U. S. Patents Bolton Continuous Drawing Machinery. Modern machines for drawing all kinds and sizes of wire by multiple dies.

*DEALERS IN A FULL LINE OF*

MACHINISTS' SUPPLY CO.

**Machinists', Mill and Railway Supplies,**
15 and 17 South Canal Street, CHICAGO, U. S. A.

MORSE TWIST DRILLS, SEND FOR CATALOGUE "B."
KEARNEY & FOOT'S FILES,
WILEY & RUSSELL'S LIGHTNING SCREW PLATES, ETC.
BILLINGS & SPENCER'S WRENCHES, ETC.


**BUYERS' FINDING LIST—Continued.**

**Shapers.**
Betts Machine Co., Wilmington, Del.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Fitchburg Machine Works, Fitchburg, Mass.
Flather & Co., Nashua, N. H.
Fox Machine Co., Grand Rapids, Mich.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
New Haven Mfg. Co., New Haven, Conn.
Niles Tool Works Co., Hamilton, O.
Ohio Machine Tool Co., The, Kenton, O.
Pratt & Whitney Co., Hartford, Conn.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Shears.**
Bliss Co., E. W., Brooklyn, N. Y.

**Shears, Rotary.**
Bethlehem Fdy. & Machine Co., South Bethlehem, Pa.

**Sight Feed Lubricators.**
Kelly & Jones Co., The, New York.

**Slotters.**
Betts Machine Co., Wilmington, Del.
Niles Tool Works Co., Hamilton, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

**Soldering Fluid.**
Elliott Chemical Works, Newton, Mass.

**Special Machinery.**
Bremer Machine Co., G. J., Kalamazoo, Mich.
Toledo Machine & Tool Co., The, Toledo, O.

**Steel.**
Abbott, Wheelock & Co., Boston, Mass.
Crescent Steel Co., Pittsburgh, Pa.
Johnson Co., The, Johnstown, Pa.
Jones & Co., B. M., Boston, Mass.
McFadden Co., Philadelphia, Pa.

**Taps and Dies.**
McFadden Co., Philadelphia, Pa.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Wilkinson Co., The, Chicago, Ill.

**Threading Machines.**
Webster & Perks Machine Tool Co., Springfield, O.

**Tool Holders.**
Armstrong Bros.' Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.

**Tramways, Overhead.**
Coburn Trolley Track Mfg. Co., Holyoke, Mass.

**Tubing, Flexible.**
Almond, T. R., Brooklyn, N. Y.

**Turret Lathes (Screw Machines).**
Bradford Mill Co., The, Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Machine Tool Co., Bridgeport, Conn.
Cleveland Machine Screw Co., Cleveland, O.
Davis & Egan Machine Tool Co., The, Cincinnati, O.
Dawson & Goodwin, Chicago, Ill.
Garvin Machine Co., New York.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Niles Tool Works Co., Hamilton, O.
Niles Tool Works Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Warner & Swasey, Cleveland, O.

**Valves.**
Jenkins Bros., New York.
Kelly & Jones Co., The, New York.

**Ventilating Fans.**
Backus Water Motor Co., Newark, N. J.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant & Co., B. F., Boston, Mass.

**Vises.**
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
McFadden Co., Philadelphia, Pa.
Niles Tool Works Co., New York.
Place Machine Co., George, New York.
Strelinger & Co., Chas. A., Detroit, Mich.
Wilkinson Co., The, Chicago, Ill.
Wyman & Gordon, Worcester, Mass.

**Water Motors.**
Backus Water Motor Co., Newark, N. J.
Tuerk Hydraulic Power Co., New York.

**Wire Machinery.**
Adt & Son, John, New Haven, Conn.
Goodyear, S. W., Waterbury, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Waterbury Machine Co., Waterbury, Conn.

**Wire Rope, Iron and Steel.**
Trenton Iron Co., The, Trenton, N. J.

**Woodworking Machinery.**
Barnes Co., W. F. & John, Rockford, Ill.
J. A. Fay & Egan Co., Cincinnati, O.
Pryibil, P., New York.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

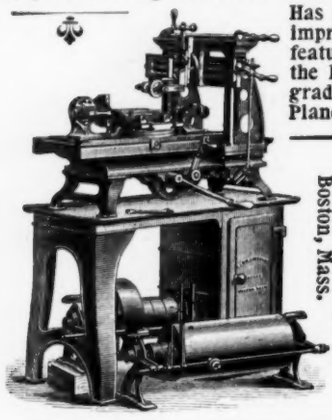
**Wrenches.**
Machinists' Supply Co., Chicago, Ill.

## Power or Hand

**PLANER** For Model Makers' Experimental Work.

Capable of doing the Best and Finest Work.

Has all the improved features of the highest grade Planers.



Manufactured by
A. J. WILKINSON & CO.
184 Washington St.,
Boston, Mass.

## T. SHRIVER & CO.

333 East 56th Street, N. Y.

**Iron and Brass Founders and Machinists**

**PULLEYS** of any size, moulded on machine —no pattern needed.

**GEARS** of any diameter, face and pitch, made on Gear Moulding Machine—no pattern needed.

How to Save Money in Blacksmith Shops.

By ORVILLE H. REYNOLDS.

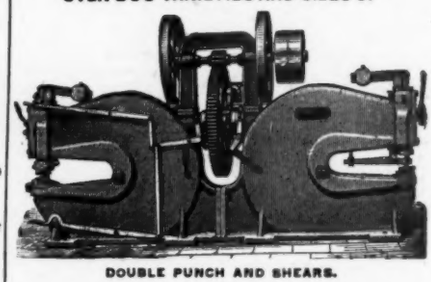
. . . ILLUSTRATED pamphlet showing operations done by dies and formers by means of bulldozer and helve hammers. Ought to be in the hands of every foreman blacksmith. Published by LOCOMOTIVE ENGINEERING.

Price 25 cents. 256 Broadway, New York.

## THE LONG & ALLSTATTER CO.,

HAMILTON, OHIO, U. S. A.

OVER 300 VARIETIES AND SIZES OF



DOUBLE PUNCH AND SHEARS.

**PUNCHES AND SHEARS**
**WELDING MACHINES**
**AND DROP HAMMERS.**

# FACE PLATE WORK

Done on our Boring and Turning Mills cheaper by from 20 to 60 per cent. than on Lathes.

**Bullard Machine Tool Co., Bridgeport, Conn.**

Ask for July Catalog. ⚜⚜⚜⚜ It gives some pointers.

## PURDUE • UNIVERSITY,

LAFAYETTE, INDIANA.

*Courses in* Mechanical Engineering,
Electrical Engineering,
Civil Engineering.

Extensive Laboratories.
Fine Equipments.

CATALOGUE SENT ON APPLICATION.

## STERLING EMERY WHEEL MFG. CO.

210 THIRD AVE., TIFFIN, O.

ALSO MANUFACTURERS OF

Advance Safety Emery and Corundum Wheels, with or without Wire Web.

## EVANS FRICTION CONE CO.

Hanging and Standing
**CONES.**
Made in all Sizes.
Thousands in use transmitting from 1 to 40 H. P.
For information address,
G. F. EVANS, Proprietor.
No. 85 Water St.,
*Boston, Mass.*

## QUINT'S TURRET DRILLS

With from 2 to 12 Spindles, will drill and tap at same operation.

ESPECIALLY ADAPTED FOR BICYCLE AND ELECTRICAL WORK.

Only the spindle in use revolves. All tools work to same point in center of table.

A. O. QUINT, Hartford, Conn.

## Special Machinery.

Adjustable 2-Spindle Drill Presses
Cutter Grinders.
Cock Grinders.
Correspondence Solicited.

Send for Photos or Blue-Prints.

FOOTE, BARKER & CO.,
49 "A" Wood St., Cleveland, O.

# ARCADE FILES

are made from the Finest Crucible Steel, and are far superior in CUTTING AND WEARING qualities to the cheap brands made from OPEN HEARTH STEEL.

Look at this file lengthwise in a slanting direction, the irregular lines show wherein Arcade Files excel.

**We guarantee** our files to cut faster and wear longer than any on the market, and will send to any responsible party, one dozen of our Arcade Files with Weed's Improved Increment Cut, and if, after test, they are not found to be the best files ever used, we will make no charge.

97 Chambers Street, New York.
118 Lake Street, Chicago, Ill.

**The Arcade File Works,**
Works: Anderson, Ind.

Makers of WEED'S PAT. INCREMENT CUT FILES

An interesting souvenir, Facts and Suggestions about Files, sent on request. New York office only.